













# CUVIER'S ANIMAL KINGDOM,

Arranged according to its Organization ;

FORMING THE BASIS FOR

A NATURAL HISTORY OF ANIMALS,

AND

AN INTRODUCTION TO COMPARATIVE ANATOMY.

MAMMALIA, BIRDS, AND REPTILES,

BY EDWARD BLYTH

THE FISHES AND RADIATA,

BY ROBERT MULLER

THE MOLLUSCOUS ANIMALS

BY GEORGE P. JOHNSON, M.D.

THE ARTICULATED ANIMALS,

BY J. O. WESTWOOD, F.R.S.

ILLUSTRATED BY THREE HUNDRED ENGRAVINGS ON WOOD.

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## PREFACE.

PERHAPS no book was ever so soon, so generally, and with so little envy, admitted to take its place at the head of that department of knowledge to which it belongs, as the *RÈGNE ANIMAL* of the illustrious Baron Cuvier. This is a high, but a just tribute, both to the work and the author; for it at once showed that the former is what had long been required, and that the latter was as much beloved for the kindness and urbanity of his manners, as he was admired for the comprehensive range and unprecedented accuracy of his views.

It must, indeed, be admitted, that, until Cuvier's great work made its appearance, we had no modern systematic arrangement of animals which applied equally to all the Classes, Orders, and Families;—which brought the extinct species into their proper situations in the living catalogue, and enabled every discoverer of a new animal, or part of an animal, instantly to connect it with its proper tribe or family. Important, however, as are the labours of this great naturalist, they could not possibly extend beyond the limits of what was known; and as Cuvier was no speculative theorist, but a rigid adherent to nature and fact, he kept his system considerably within the limits of those who were more speculative, and consequently less accurate.

For students, no work is equal to that of Cuvier, for it is at once comprehensive and concise; and though the student may choose a particular department, and require books more in detail with reference to that department, he must still have the *RÈGNE ANIMAL* to point out to him the general analogies of the living creation. The present work is a complete Cuvier, as regards the essential part of the arrangement; and it is not a mere translation, but in some respects a new book, embodying the original one. Throughout the whole of it, there will be found original remarks; but these are always distinguished from that which belongs to Cuvier, by being inclosed within brackets. This mode of arrangement was thought to be much better than the appending

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of notes, which always divide the attention of the reader, and weaken the interest of the subject. Many of the classes and orders have been reinvestigated, and new species added. This is most extensively done in the departments which were intrusted to Mr. BLYTH and Mr. WESTWOOD; but it runs more or less throughout the whole; and the publishers flatter themselves that this will be of great service to all students of this highly interesting branch of knowledge. The style in which the book is brought out will speak for itself. The different sizes of type, which bear some proportion to the comparative importance of the subject, will enable the reader to glean an outline of the system;—to obtain something more than a bare outline, he must read the entire work, which in the present edition embodies all the discoveries of more recent naturalists.

London, June, 1840.

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THE  
ANIMAL KINGDOM.

PREFACE TO THE FIRST EDITION.

HAVING been devoted, from my earliest youth, to the study of comparative anatomy, that is to say of the laws of the organization of animals, and of the modifications which this organization undergoes in the various species, and having, for nearly thirty years past, consecrated to that science every moment of which my duties allowed me to dispose, the constant aim of my labours has been to reduce it to general rules, and to propositions that should contain their most simple expression. My first essays soon led me to perceive that I could only attain this object in proportion as the animals, whose structure I should have to elucidate, were arranged in conformity with that structure, so that under one single name, of class, order, genus, &c., might be embraced all those species which, in their internal as well as exterior conformation, present accordancies either more general or more particular. Now this is what the greater number of naturalists of that epoch had never sought to effect, and what but few of them could have achieved, even had they been willing to try; since a parallel arrangement presupposes a very extensive knowledge of the structures, of which it ought, in some measure, to be the representation.

It is true that Daubenton and Camper had supplied facts,—that Pallas had indicated views; but the ideas of these well-informed men had not yet exercised upon their contemporaries the influence which they merited. The only general catalogue of animals then in existence, and the only one we possess even now,—the system of Linnæus,—had just been disfigured by an unfortunate editor, who did not so much as take the trouble to comprehend the principles of that ingenious classifier, and who, wherever he found any disorder, seems to have tried to render it more inextricable.

It is also true that there were very extensive works upon particular classes, which had made known a vast number of new species; but their authors barely considered the external relations of those species, and no one had employed himself in co-arranging the classes and orders according to their entire structure: the characters of several classes remained false or incomplete, even in justly celebrated anatomical works; some of the orders were arbitrary; and in scarcely any of these divisions were the genera approximated conformably to nature.

I was necessitated then,—and the task occupied considerable time,—I was compelled to make anatomy and zoology, dissection and classification, proceed beforehand; to seek, in my first remarks on organization, for better principles of distribution; to employ these, in order to arrive at new remarks; and in their turn the latter, to carry the principles of distribution to perfection: in fine, to elicit from the mutual reaction of the two sciences upon each other, a system of zoology adapted to serve as an introduction and a guide in anatomical researches, and a body of anatomical doctrine fitted to develop and explain the zoological system.

The first results of this double labour appeared in 1795, in a special memoir upon a new division of the white-blooded animals. A sketch of their application to genera, and to the division of these into sub-genera, formed the object of my *Tableau Élémentaire des Animaux*, printed in 1798, and I improved this work, with the assistance of M. Dumeril, in the tables annexed to the first volume of my *Leçons d'Anatomie Comparée*, in 1800.

I should, perhaps, have contented myself with perfecting these tables, and proceeded immediately to the publication of my great work on anatomy, if, in the course of my researches, I had not been frequently struck with another defect of the greater number of the general or partial systems of zoology; I mean, the confusion in which the want of critical precision had left a vast number of species, and even many genera.

Not only were the classes and orders not sufficiently conformed to the intrinsic nature of animals, to serve conveniently as the basis to a treatise on comparative anatomy, but the genera themselves, though ordinarily better constituted, offered but inadequate resources in their nomenclature, on account of the species not having been arranged under each of them, conformably to their characters. Thus, in placing the Manati in the genus *Morse*, the Siren in that of the *Eels*, Gmelin had rendered any general proposition relative to the organization of these genera impossible; just as by approximating in the same class and in the same order, and placing side by side, the Cuttle and the fresh-water Polypus, he had made it impossible to predicate anything generally of the class and order which comprised such incongruous beings.

I select the above examples from among the most prominent; but there existed an infinitude of such mistakes, less obvious at the first glance, which occasioned inconveniences not less real.

It was not sufficient, then, to have imagined a new distribution of the classes and orders, and to have properly placed the genera; it was also necessary to examine all the species, in order to be assured that they really belonged to the genera in which they had been placed.

Having come to this, I found not only species grouped or dispersed contrary to all reason, but I remarked that many had not been established in a positive manner, either by the characters which had been assigned to them, or by their figures and descriptions.

Here one of them, by means of synonymes, represents several under a single name, and often so different that they should not rank in the same genus: there a single one is doubled, tripled, and successively reappears in several sub-genera, genera, and sometimes different orders.

What can be said, for example, of the *Trichechus manatus* of Gmelin, which, under a single specific name, comprehends three species and two genera,—two genera differing in almost everything? By what name shall we speak of the *Veella*, which figures

twice among the *Medusæ* and once among the *Holothuriæ*? How are we to reassemble the *Biphoræ*, of which some are there called *Dagysa*, the greater number *Salpa*, while several are ranged among the *Holothuriæ*?

It did not therefore suffice, in order completely to attain the object aimed at, to review the species: it was necessary to examine their synonymes; or, in other words, to re-model the system of animals.

Such an enterprize, from the prodigious developement of the science of late years, could not have been executed completely by any one individual, even granting him the longest life, and no other occupation. Had I been constrained to depend upon myself alone, I should not have been able to prepare even the simple sketch which I now give; but the resources of my position seemed to me to supply what I wanted both of time and talent. Living in the midst of so many able naturalists, drawing from their works as fast as they appeared, freely enjoying the use of the collections they had made, and having myself formed a very considerable one, expressly appropriated to my object, a great part of my labour consisted merely in the employment of so many rich materials. It was not possible, for instance, that much remained for me to do on shells, studied by M. de Lamarck, nor on quadrupeds, described by M. Geoffroy. The numerous and new affinities described by M. de Lacepède, were so many data for my system of fishes. M. Levaillant, among so many beautiful birds collected from all parts, perceived details of organization which I immediately adapted to my plan. My own researches, employed and fructified by other naturalists, yielded results to me which, in my hands alone, they would not all have produced. So, also, M. de Blainville and M. Oppel, in examining the cabinet which I had formed of anatomical preparations on which I designed to found my divisions of reptiles, anticipated—and perhaps better than I should have done—results of which as yet I had but a glimpse, &c., &c.

Encouraged by these reflections, I determined to precede my Treatise on Comparative Anatomy by a kind of abridged system of animals, in which I should present their divisions and subdivisions of all degrees, established in a parallel manner upon their structure, both internal and external; where I would give the indication of well-authenticated species that belonged, with certainty, to each of the subdivisions; and where, to create more interest, I would enter into some details upon such of the species as, from their abundance in our country, the services which they render us, the damage which they occasion to us, the singularity of their manners and economy, their extraordinary forms, their beauty, or their magnitude, are the most remarkable.

I hoped by so doing to prove useful to young naturalists, who, for the most part, have but little idea of the confusion and errors of criticism in which the most accredited works abound, and who, particularly in foreign countries, do not sufficiently attend to the study of the true relations of the conformation of beings: I considered myself as rendering a more direct service to those anatomists, who require to know beforehand to which orders they should direct their researches, when they wish to solve by comparative anatomy some problem of human anatomy or physiology, but whose ordinary occupations do not sufficiently prepare them for fulfilling this condition, which is essential to their success.

Nevertheless, I have not professed to extend this twofold view equally to all classes of the animal kingdom; and the vertebrated animals, as in every sense the most in-

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teresting, claimed to have the preference. Among the *Invertebrata*, I have had more particularly to study the naked mollusks and the great zoophytes ; but the innumerable variations of the external forms of shells and corals, the microscopic animals, and the other families which perform a less obvious office in the economy of nature, or whose organization affords but little room for the exercise of the scalpel, did not require to be treated with the same detail. Independently of which, so far as the shells and corals are concerned, I could depend on a work just published by M. de Lamarck, in which will be found all that the most ardent desire for information can require.

With respect to insects, so interesting by their external forms, their organization, habits, and by their influence on all living nature, I have had the good fortune to find assistance which, in rendering my work infinitely more perfect than it could have been had it emanated solely from my pen, has, at the same time, greatly accelerated its publication. My colleague and friend, M. Latreille, who has studied these animals more profoundly than any other man in Europe, has kindly consented to give, in a single volume, and nearly in the order adopted for the other parts, a summary of his immense researches, and an abridged description of those innumerable genera which entomologists are continually establishing.

As for the rest, if in some instances I have given less extent to the exposition of sub-genera and species, this inequality has not occurred in aught that concerns the superior divisions and the indications of affinities, which I have every where founded on equally solid bases, established by equally assiduous researches.

I have examined, one by one, all the species of which I could procure specimens ; I have approximated those which merely differed from each other in size, colour, or in the number of some less important parts, and have formed them into what I designate a sub-genus.

Whenever it was possible, I have dissected at least one species of each sub-genus ; and if those be excepted to which the scalpel cannot be applied, there exists in my work but very few groups of this degree, of which I cannot produce some considerable portion of the organs.

After having determined the names of the species which I had examined, and which had previously been either well figured or well described, I placed in the same sub-genera those which I had not seen, but whose exact figures, or descriptions, sufficiently precise to leave no doubt of their natural relations, I found in authors ; but I have passed over in silence that great number of vague indications, on which, in my opinion, naturalists have been too eager to establish species, the adoption of which has mainly contributed to introduce into the catalogue of beings, that confusion which deprives it of so much of its utility.

I could have added, almost every where, a vast number of new species ; but as I could not refer to figures, it would have been incumbent on me to extend their descriptions beyond what space permitted ; I have, therefore, preferred depriving my work of this ornament, and have only indicated those, the peculiar conformation of which gives rise to new sub-genera.

My sub-genera once established on positive relations, and composed of well-authenticated species, it remained only to construct this great scaffolding of genera, tribes, families, orders, classes, and primary divisions, which constitute the entire animal kingdom.

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In this I have proceeded, partly by ascending from the inferior to the superior divisions, by means of approximation and comparison ; and partly also by descending from the superior to the inferior groups, on the principle of the subordination of characters ; comparing carefully the results of the two methods, verifying one by the other, and always sedulously establishing the correspondence of external and internal structure, which, the one as well as the other, are integral parts of the essence of each animal.

Such has been my procedure whenever it was necessary and possible to introduce new arrangements ; but I need not observe that, in very many places, the results to which it would have conducted me had already been so satisfactorily obtained, that I had only to follow the track of my predecessors. Notwithstanding which, even in those cases where no alteration was required, I have verified and confirmed, by new observations, what was previously acknowledged, and what I did not adopt until it had been subjected to a rigorous scrutiny.

The public may form some idea of this mode of examination, from the memoirs on the anatomy of mollusks, which have appeared in the *Annales du Museum*, and of which I am now preparing a separate and augmented collection. I venture to assure the reader that I have bestowed quite as extensive labour upon the vertebrated animals, the annelides, the zoophytes, and on many of the insects and crustaceans. I have not deemed it necessary to publish it with the same detail ; but all my preparations are exposed in the Cabinet of Comparative Anatomy in the Jardin du Roi, and will serve hereafter for my treatise on anatomy.

Another very considerable labour, but the details of which cannot be so readily authenticated, is the critical examination of species. I have verified all the figures alleged by different authors, and as often as possible referred each to its true species, previously to selecting those which I have indicated : it is entirely from this verification, and never from the classification of preceding systematists, that I have referred to my sub-genera the species that belong to them. Such is the reason why no astonishment should be experienced on finding that such and such a genus of Gmelin is now divided, and distributed even in different classes and still higher divisions ; that numerous nominal species are reduced to a single one, and that popular names are very differently applied. There is not one of these changes which I am not prepared to justify, and of which the reader himself may not obtain the proof, by recurring to the sources which I have indicated.

In order to lessen his trouble, I have been careful to select for each class a principal author, generally the richest in good original figures ; and I quoted secondary works only where the former are deficient, or where it was useful to establish some comparison, for the sake of confirming synonyms.

My subject could have been made to fill many volumes ; but I considered it my duty to condense it, by imagining abridged means of expression. These I have obtained by graduated generalities. By never repeating for a species that which might be said of an entire sub-genus, nor for a genus what might be applied to a whole order, and so on, we arrive at the greatest economy of words. To this my endeavours have been, above all, particularly directed, inasmuch as it was the principal end of my work. It may be remarked, however, that I have not employed many technical terms, and that I have endeavoured to communicate my ideas without that barbarous array of fictitious words, which, in the works of so many modern naturalists, prove



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so very repulsive. I cannot perceive, however, that I have thereby lost any thing in precision or clearness.

I have been compelled, unfortunately, to introduce many new names, although I have endeavoured, as far as possible, to preserve those of my predecessors; but the numerous sub-genera I have established required these denominations; for in things so various, the memory is not satisfied with numerical indications. I have selected them, so as either to convey some character, or among the common names which I have latinized, or lastly, after the example of Linnæus, from among those of mythology, which are generally agreeable to the ear, and which we are far from having exhausted.

In naming species, however, I would nevertheless recommend employing the substantive of the genus, and the trivial name only. The names of the sub-genera are designed merely as a relief to the memory, when we would indicate these subdivisions in particular. Otherwise, as the sub-genera, already very numerous, will in the end become greatly multiplied, in consequence of having substantives continually to retain, we shall be in danger of losing the advantages of that binary nomenclature so happily imagined by Linnæus.

It is the better to preserve it that I have dismembered as little as possible the great genera of that illustrious reformer of science. Whenever the sub-genera into which I divide them were not to be translated into different families, I have left them together under their former generic appellation. This was not only due to the memory of Linnæus, but was necessary in order to preserve the mutual intelligence of the naturalists of different countries.

To facilitate still more the study of this work,—for it is to be studied more than to be glanced over,—I have employed different-sized types in the printing of it, to correspond to the different grades of generalization of the statements contained in it. \* \* \* Thus the eye will distinguish beforehand the relative importance of each group, and the order of each successive idea; and the printer will second the author with every contrivance which his art supplies, that may conduce to assist the memory.

The habit, necessarily acquired in the study of natural history, of mentally classifying a great number of ideas, is one of the advantages of this science, which is seldom spoken of, and which, when it shall have been generally introduced into the system of common education, will perhaps become the principal one: it exercises the student in that part of logic which is termed method, as the study of geometry does in that which is called syllogism, because natural history is the science which requires the most precise methods, as geometry is that which demands the most rigorous reasoning. Now this art of method, when once well acquired, may be applied with infinite advantage to studies the most foreign to natural history. Every discussion which supposes a classification of facts, every research which requires a distribution of matters, is performed after the same manner; and he who had cultivated this science merely for amusement, is surprised at the facilities it affords for disentangling all kinds of affairs.

It is not less useful in solitude. Sufficiently extensive to satisfy the most powerful mind, sufficiently various and interesting to calm the most agitated soul, it consoles the unhappy, and tends to allay enmity and hatred. Once elevated to the contemplation of that harmony of Nature irresistibly regulated by Providence, how weak and

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trivial appear those causes which it has been pleased to leave dependent on the will of man ! How astonishing to behold so many fine minds, consuming themselves, so uselessly for their own happiness and that of others, in the pursuit of vain combinations, the very traces of which a few years suffice to obliterate !

I avow it proudly, these ideas have been always present to my mind,—the companions of my labours ; and if I have endeavoured by every means in my power to advance this peaceful study, it is because, in my opinion, it is more capable than any other of supplying that want of occupation, which has so largely contributed to the troubles of our age ;—but I must return to my subject.

There yet remains the task of accounting for the principal changes I have effected in the latest received methods, and to acknowledge the amount of obligation to those naturalists, whose works have furnished or suggested a part of them.

To anticipate a remark which will naturally occur to many, I must observe that I have neither pretended nor desired to class animals so as to form a single line, or as to mark their relative superiority. I even consider every attempt of this kind impracticable. Thus, I do not mean that the mammalia or birds which come last, are the most imperfect of their class ; still less do I intend that the last of mammalia are more perfect than the first of birds, or the last of mollusks more perfect than the first of the annelides, or zoophytes ; even restricting the meaning of this vague word *perfect* to that of “ most completely organized.” I regard my divisions and subdivisions as the merely graduated expression of the resemblance of the beings which enter into each of them ; and although in some we observe a sort of passage or gradation from one species into another, which cannot be denied, this disposition is far from being general. The pretended chain of beings, as applied to the whole creation, is but an erroneous application of those partial observations, which are only true when confined to the limits within which they were made ; and, in my opinion, it has proved more detrimental to the progress of natural history in modern times, than is easy to imagine.

It is in conformity with these views, that I have established my four principal divisions, which have already been made known in a separate memoir. I still think that it expresses the real relations of animals more exactly than the old arrangement of *Vertebrata* and *Invertebrata*, for the simple reason, that the former animals have a much greater mutual resemblance than the latter, and that it was necessary to mark this difference in the extent of their relations.

M. Virey, in an article of the *Nouveau Dictionnaire d'Histoire Naturelle*, had already discerned in part the basis of the division, and principally that which reposes on the nervous system.

The particular approximation of oviparous *Vertebrata*, inter se, originated from the curious observations of M. Geoffroy on the composition of bony heads, and from those which I have added to them relative to the rest of the skeleton, and to the muscles.

In the class of *Mammalia*, I have brought back the *Solipedes* to the *Pachydermata*, and have divided the latter into families on a new plan ; the *Ruminantia* I have placed at the end of the quadrupeds ; and the *Manati* near the *Cetacea*. The distribution of the *Carnaria* I have somewhat altered ; the *Oustitis* have been wholly separated from the Monkeys, and a sort of parallelism indicated between the *Marsupiated* and other digitated quadrupeds, the whole from my own anatomical researches. All that I have

given on the *Quadrumana* and the Bats is based on the recent and profound labours of my friend and colleague M. Geoffroy de St. Hilaire. The researches of my brother, M. Frederic Cuvier, on the teeth of the *Carnaria* and *Rodentia*, have proved highly useful to me in forming the sub-genera of these two orders. Notwithstanding the genera of the late M. Illiger are but the results of these same studies, and of those of some foreign naturalists, I have adopted his names whenever his genera corresponded with my sub-genera. M. de Lacepède has also discerned and indicated many excellent divisions of this degree, which I have been equally compelled to adopt; but the characters of all the degrees and all the indications of species have been taken from nature, either in the Cabinet of Anatomy or in the galleries of the Museum.

The same plan was pursued with respect to the Birds. I have examined with the closest attention more than four thousand individuals in the Museum; I arranged them according to my views in the public gallery more than five years ago, and all that is said of this class has been drawn from that source. Thus, any resemblance which my sub-divisions may bear to some recent descriptions, is on my part purely accidental.\*

Naturalists, I hope, will approve of the numerous sub-genera which I have deemed it necessary to make among the birds of prey, the *Passerine*, and the Shore-birds; they appear to me to have completely elucidated genera hitherto involved in much confusion. I have marked, as exactly as I could, the accordance of these subdivisions with the genera of MM. de Lacepède, Meyer, Wolf, Temminck, and Savigny, and have referred to each of them all the species of which I could obtain a very positive knowledge. This laborious work will prove of value to those who may hereafter attempt a true history of birds. The splendid works on Ornithology published within a few years, and those chiefly of M. le Vaillant, which are filled with so many interesting observations, together with M. Vieillot's, have been of much assistance to me in designating the species which they represent.

The general division of this class remains as I published it in 1798, in my *Tableau Élémentaire*.†

I have thought proper to preserve for the Reptiles, the general division of my friend M. Brongniart; but I have prosecuted very extensive anatomical investigations to arrive at the ulterior subdivisions. M. Oppel, as I have already stated, has partly taken advantage of these preparatory labours; and whenever my genera finally agreed with his, I have noticed the fact. The work of Daudin, indifferent as it is, has been useful to me for indications of details; but the particular divisions which I have given in the genera of Monitors and Geckos, are the product of my own observations on a great number of Reptiles recently brought to the Museum by MM. Péron and Geoffroy.

My labours on the Fishes will probably be found to exceed those which I have bestowed on the other vertebrated animals. Our Museum having received a vast number of Fishes since the celebrated work of M. de Lacepède was published, I have been enabled to add many subdivisions to those of that learned naturalist, also to combine several species differently, and to multiply anatomical observations. I have also had

\* This observation not having been sufficiently understood abroad, I am obliged to repeat it here, and openly to declare a fact witnessed by thousands in Paris; it is this, that all the birds in the gallery of the Museum were named and arranged according to my system, in 1811. Those even of my subdivisions to which I had not yet given names, were marked by particular signs. This is my date. Independently of this, my first volume was printed in the beginning of

1816. Four volumes are not printed so quickly as a pamphlet of a few pages. I say no more. (Note to Edit. 1839).

† I only mention this because an estimable naturalist, M. Vieillot, has, in a recent work, attributed to himself the union of the *Pisces* and *Passeres*. I had printed it in 1798, together with my other arrangements, so as to render them public in the Museum since 1811 and 1812.

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better means of verifying the species of Commerson, and of some of other travellers; and, upon this point, I am much indebted to a review of the drawings of Commerson, and of the dried fishes which he brought with him, by M. Dumeril, but which have only been very lately recovered;—resources to which I have added those presented to me in the fishes brought by Péron from the Indian Ocean and Archipelago, those which I obtained in the Mediterranean, and the collections made on the coast of Coromandel by the late M. Sonnerat, at the Mauritius by M. Matthieu, in the Nile and Red Sea, by M. Geoffroy, &c. I was thus enabled to verify most of the species of Bloch, Russell, and others, and to prepare the skeletons and viscera of nearly all the sub-genera; so that this part of the work will, I presume, offer much that is new to Ichthyologists.

As to my division of this class, I confess its inconvenience, but I believe it, nevertheless, to be more natural than any preceding one. In publishing it some time ago, I only offered it for what it is worth; and if any one should discover a better principle of division, and as conformable to the organization, I shall hasten to adopt it.

It is admitted that all the works on the general division of the invertebrated animals, are mere modifications of what I proposed in 1795, in the first of my memoirs; and the time and care which I have devoted to the anatomy of mollusks in general, and principally to the naked mollusks, are well known. The determining of this class, as well as of its divisions and subdivisions, rests upon my own observations; the magnificent work of M. Poli had alone anticipated me by descriptions and anatomical researches useful for my design, but confined to bivalves and multivalves only. I have verified all the facts furnished by that able anatomist, and I believe that I have more justly marked the functions of some organs. I have also endeavoured to determine the animals to which belong the principal forms of shells, and to arrange the latter from that consideration; but with regard to the ulterior divisions of those shells of which the animals resemble each other, I have examined them only so far as to enable me to describe briefly those admitted by MM. de Lamarck and de Montfort; even the small number of genera and sub-genera which are properly mine, are principally derived from observations on the animals: In citing examples, I have confined myself to a certain number of the species of Martini, Chemnitz, Lister, and Soldani; and that only because, the volume in which M. Lamarck treats of this portion not having yet appeared, I was compelled to fix the attention of my readers on specific objects. But in the choice and determining of these species, I lay no claim to the same critical accuracy which I have employed for the vertebrated animals and naked mollusks.

The excellent observations of MM. Savigny, Lesueur, and Desmarest, on the compound Ascidiæ, approximate this latter family of mollusks to certain orders of zoophytes: this is a curious relation, and a further proof of the impracticability of arranging animals in a single line.

I believe that I have extricated the Annelides,—the establishing of which, although not their name, belongs virtually to me,—from the confusion in which they had hitherto been involved, among the Mollusks, the Testacea, and the Zoophytes, and have placed them in their natural order; even their genera have received some elucidation only by my observations, published in the *Dictionnaire des Sciences Naturelles*, and elsewhere.

Of the three classes contained in the third volume, I have nothing to remark.

M. Latreille, who, with the exception of some anatomical details, founded on my own observations and those of M. Ramdohr, which I have inserted in his text, is its sole author, will take upon himself to explain all that is necessary.

As to the Zoophytes, which terminate the Animal Kingdom, I have availed myself, for the Echinoderms, of the recent work of M. de Lamarck; and for the Intestinal Worms, of that of M. Rudolphi, intitled *Entozoa*; but I have anatomized all the genera, some of which have been determined by me only. There is an excellent work by M. Tiédemann, on the anatomy of the Echinoderms, which received the prize of the Institute some years ago, and will shortly appear; it will leave nothing to be desired respecting these curious animals. The Corals and the Infusoria, offering no field for anatomical investigations\*, will be briefly disposed of. The new work of M. de Lamarck will supply my deficiencies.†

With respect to authors, I can only here mention those who have furnished me with general views, or who were the origin of such in my own mind.‡ There are many others to whom I am indebted for particular facts, and whose names I have carefully quoted wherever I have made use of them. They will be found on every page of my book. Should I have omitted to do justice to any, it must be attributed to involuntary forgetfulness, and I ask pardon beforehand: there is no property, in my opinion, more sacred than the conceptions of the mind; and the custom, too prevalent among naturalists, of masking plagiarisms by a change of names, has always appeared to me a crime.

The publication of my Comparative Anatomy will now occupy me every moment: the materials are ready; a vast quantity of preparations and drawings are arranged; and I shall be careful in dividing the work into parts, each of which will form a whole, so that, should my physical powers prove insufficient for the completion of my design, what I have produced will still form entire suites, and the materials I have collected be in immediate readiness for those who may undertake the continuation of my labours.

Jardin du Roi, October, 1816.

## ADVERTISEMENT TO THE SECOND EDITION.

THE preceding preface explains faithfully the condition in which I found the history of animals when the first edition of this work was published. During the twelve years that have since elapsed, this science has made immense progress, not only from the acquisitions of numerous travellers, as well-instructed as courageous, who have explored every region of the globe, but by the rich collections which various governments have formed and rendered public, and by the learned and

\* The surprising researches of M. Ehrenberg, now publishing from time to time, triumphantly refute this allegation.—Ed.

† I have just received *L'Histoire des Polyptères corréligènes fertiles* of M. Lamouroux, which furnishes an excellent supplement to

M. de Lamarck.

‡ M. de Blainville has recently published general zoological tables, which I regret came too late for me to profit by, having appeared when my book was nearly printed.

splendid works, wherein new species are described and figured, and of which the authors have striven to detect their mutual relations, and to consider them in every point of view.\*

I have endeavoured to avail myself of these discoveries, as far as my plan permitted, by first studying the innumerable specimens received at the Cabinet du Roi, and comparing them with those which served as the basis of my first edition, in order thence to deduce new approximations or subdivisions; and then, by searching in all the books I could procure for the genera or sub-genera established by naturalists, and the descriptions of species by which they have supported these numerous combinations.

The determination of synonymes has become much easier now than at the period of my first edition. Both French and foreign naturalists appear to have recognized the necessity of establishing divisions in the vast genera in which such incongruous species were formerly heaped together; their groups are now precise and well-defined; their descriptions sufficiently detailed; their figures scrupulously exact to the most minute characters, and often of the greatest beauty as works of art. Scarcely any difficulty remains, therefore, in identifying their species, and nothing hinders them from coming to an understanding with respect to the nomenclature. This, unfortunately, has been the most neglected; the names of the same genera, and the same species, are multiplied as often as they are mentioned; and should this discord continue, the same chaos will be produced that previously existed, though arising from another cause.

I have used every effort to compare and approximate these redundancies, and, forgetting even my own trifling interest as an author, have often indicated names which seemed to have been imagined only to escape the avowal of having borrowed my divisions. But thoroughly to execute this undertaking,—this *pinax* or rectified epitome of the animal kingdom, which becomes every day more necessary,—to discuss the proofs and fix the definitive nomenclature which should be adopted, by basing it on sufficient figures and descriptions, requires more space than I could dispose of, and a time imperatively claimed by other works. In the History of Fishes, which I have commenced publishing, with the assistance of M. Valenciennes, I purpose to give an idea of what appears to me might be effected in all parts of the science. Here, I only profess to offer an abridged summary—a simple sketch;—well satisfied if I succeed in rendering this accurate in all its details.

Various essays of a similar kind have been published on some of the classes, and I have carefully studied them with a view to perfect my own. The *Mammalogie* of M. Desmarest, that of M. Lesson, the Treatise on the Teeth of Quadrupeds, by M. Frederic Cuvier, the English translation of my first edition, by Mr. Griffith, enriched by numerous additions, particularly by Hamilton Smith; the new edition of the *Manuel d'Ornithologie* of M. Temminck, the Ornithological Fragments of M. Wagler, the History of Reptiles of the late Merrem, and the Dissertation on the same subject by M. Fitsinger, have principally been useful to me for the vertebrated animals. The *Histoire des Animaux sans Vertèbres* of M. de Lamarck, the *Malacologie* of M. de Blainville, have also been of great service to me for the mollusks. To

\* See my discourse before the Institute on the *Progres de l'histoire naturelle depuis la pale maritime*, published at the close of the first volume of my *Eloges*.

these I have added the new views and facts contained in the numerous and learned writings of MM. Geoffroy St. Hilaire, father and son, Savigny, Temminck, Lichtenstein, Kuhl, Wilson, Horsfield, Vigors, Swainson, Gray, Ord, Say, Harlan, Charles Bonaparte, Lamouroux, Mitchell, Lesueur, and many other able and studious men, whose names will be carefully mentioned when I speak of the subjects on which they have treated.

The fine collections of engravings which have appeared within the last twelve years, have enabled me to indicate a greater number of species; and I have amply profited by this facility. I must particularly acknowledge what I owe on this score to the *Histoire des Mammifères* of MM. Geoffroy St. Hilaire and Frederic Cuvier, the *Planches coloriées* of MM. Temminck and Laugier, the *Galerie des Oiseaux* of M. Vieillot, the new edition of the Birds of Germany, by MM. Nauman, the Birds of the United States of Messrs. Wilson, Ord, and Charles Bonaparte\*, the great works of M. Spix, and of his Highness the Prince Maximilian de Wied, on the Animals of Brazil, and to those of M. de Ferussac on the Mollusks. The plates and zoological descriptions of the travels of MM. Freycinet and Duperrey, supplied in the first by MM. Quoy and Gaymard, in the second by MM. Lesson and Garnot, also present many new objects. The same must be said of the Animals of Java, by Dr. Horsfield. Though on a smaller scale, new figures of rare species are to be found in the *Mémoires du Muséum*, the *Annales des Sciences Naturelles*, and other French periodicals, in the Zoological Illustrations of Mr. Swainson, and in the Zoological Journal, published by able naturalists in London. The Journal of the Lyceum of New York, and of the Academy of Natural Sciences of Philadelphia, are not less valuable; but in proportion as the taste for natural history becomes extended, and the more numerous the countries in which it is cultivated, the number of its acquisitions increases in geometrical progression, and it becomes more and more difficult to collect all the writings of naturalists, and to complete the table of their results. I rely, therefore, on the indulgence of those whose observations may have escaped me, or whose works I have not sufficiently consulted.

My celebrated friend and colleague M. Latreille, having consented, as in the first edition, to take upon himself the important and difficult part of the Crustaceans, Arachnides, and Insects, will himself explain in an advertisement the plan he has followed, so that I need say nothing more on this subject.

\* \* \* \* \*

Jardin du Roi, October, 1828.

\* The work of M. Audubon upon the Birds of North America, which surpasses all others in magnificence, was unknown to me till after the whole of that part which treats of Birds was printed.

## INTRODUCTION.

### OF NATURAL HISTORY, AND OF SYSTEMS GENERALLY.

As few persons have a just idea of *Natural History*, it appears necessary to commence our work by carefully defining the proposed object of this science, and establishing rigorous limits between it and the contiguous sciences.

The word **NATURE**, in our language, and in most others, signifies—sometimes, the qualities which a being derives from birth, in opposition to those which it may owe to art; at other times, the aggregate of beings which compose the universe; and sometimes, again, the laws which govern these beings. It is particularly in this latter sense that it has become customary to personify Nature, and to employ the name, respectfully, for that of its Author.

*Physics*, or *Natural Philosophy*, treats of the nature of these three relations, and is either general or particular. *General Physics* examines, abstractedly, each of the properties of those moveable and extended beings which we call bodies. That department of them styled *Dynamics*, considers bodies in mass; and, proceeding from a very small number of experiments, determines mathematically the laws of equilibrium, and those of motion and of its communication. It comprehends in its different divisions the names of *Statics*, *Mechanics*, *Hydrostatics*, *Hydrodynamics*, *Pneumatics*, &c., according to the nature of the bodies of which it examines the motions. *Optics* considers the particular motions of light; the phenomena of which, requiring experiments for their determination, are becoming more numerous.

*Chemistry*, another branch of General Physics, expounds the laws by which the elementary molecules of bodies act on each other when in close proximity, the combinations or separations which result from the general tendency of these molecules to unite, and the modifications which different circumstances, capable of separating or approximating them, produce on that tendency. It is a science almost wholly experimental, and which cannot be reduced to calculation.

The theory of Heat, and that of Electricity, belong almost equally to Dynamics or Chemistry, according to the point of view in which they are considered.

The method which prevails in all the branches of General Physics consists in isolating bodies, reducing them to their utmost simplicity, in bringing each of their properties separately into action, either mentally or by experiment, in observing or calculating the results, in short, in generalizing and correcting the laws of these pro-



perties for the purpose of establishing a body of doctrine, and, if possible, of referring the whole to one single law, under the universal expression of which all might be resolved.

*Particular Physics*, or *Natural History*,—for these terms are synonymous—has for its object to apply specially the laws recognized by the various branches of General Physics, to the numerous and varied beings which exist in nature, in order to explain the phenomena which they severally present.

In this extended sense, it would also include Astronomy; but that science, sufficiently elucidated by Mechanics, and completely subjected to its laws, employs methods too different from those required by ordinary Natural History, to permit of its cultivation by the students of the latter.

*Natural History*, then, is confined to objects which do not allow of rigorous calculation, or of precise measurement in all their parts. *Meteorology*, also, is subtracted from it, to be ranged under General Physics; so that, properly speaking, it considers only inanimate bodies, called minerals, and the various kinds of living beings, in all which we may observe the effects, more or less various, of the laws of motion and chemical attraction, and of all the other causes analyzed by General Physics.

Natural History should, in strictness, employ the same modes of procedure as the general sciences; and it does so, in fact, whenever the objects of its study are so little complex as to permit of it. But this is very seldom the case.

An essential difference, in effect, between the general sciences and Natural History is, that, in the former, phenomena are examined, the conditions of which are all regulated by the examiner, in order, by their analysis, to arrive at general laws; while in the latter, they occur under circumstances beyond the control of him who studies them for the purpose of discovering, amid the complication, the effects of general laws already known. It is not permitted for him, as in the case of the experimenter, to subtract successively from each condition, and so reduce the problem to its elements; but he must take it entire, with all its conditions at once, and can analyze only in thought. Suppose, for example, we attempt to isolate the numerous phenomena which compose the life of an animal a little elevated in the scale; a single one being suppressed, the life is wholly annihilated.

Dynamics have thus become a science almost purely of calculation; Chemistry is still a science wholly [*chiefly\**] of experiment; and Natural History will long remain, in a great number of its branches, one of pure observation.

These three terms sufficiently designate the modes of procedure employed in the three branches of the Natural Sciences; but in establishing between them very different degrees of certitude, they at the same time indicate the point to which the two latter should tend, in order to approach perfection.

Calculation, so to speak, commands Nature; it determines phenomena more exactly than observation can make them known: experiment forces her to unveil; while observation watches her when deviating from her normal course, and seeks to surprise her.

Natural History has, moreover, a principle on which to reason, which is peculiar to it, and which it employs advantageously on many occasions; it is that of the *conditions of existence*, commonly termed *final causes*. As nothing can exist without the concurrence of those conditions which render its existence possible, the component parts of each

\* The discovery of the atomic theory has reduced many of its phenomena to calculation.—E.S.

must be so arranged as to render possible the whole living being, not only with regard to itself, but to its surrounding relations; and the analysis of these conditions frequently conducts to general laws, as demonstrable as those which are derived from calculation or experiment.

It is only when all the laws of general physics, and those which result from the conditions of existence, are exhausted, that we are reduced to the simple laws of observation.

The most effectual mode of observing is by comparison. This consists in successively studying the same bodies in the different positions in which Nature places them, or in a comparison of different bodies together, until constant relations are recognized between their structures and the phenomena which they manifest. These various bodies are kinds of experiments ready prepared by Nature, who adds to or subtracts from each of them different parts, just as we might wish to do in our laboratories, and shows us herself the results of such additions or retrenchments.

It is thus that we succeed in establishing certain laws, which govern these relations, and which are employed like those that have been determined by the general sciences.

The incorporation of these laws of observation with the general laws, either directly or by the principle of the conditions of existence, would complete the system of the natural sciences, in rendering sensible in all its parts the mutual influence of every being. This it is to which the efforts of those who cultivate these sciences should tend.

All researches of this kind, however, presuppose means of distinguishing with certainty, and causing others to distinguish, the objects investigated; otherwise we should be incessantly liable to confound the innumerable beings which Nature presents. Natural History, then, should be based on what is called a *System of Nature*, or a great catalogue, in which all beings bear acknowledged names, may be recognized by distinctive characters, and distributed in divisions and subdivisions themselves named and characterized, in which they may be found.

In order that each being may always be recognized in this catalogue, it should carry its character along with it: for which reason the characters should not be taken from properties, or from habits the exercise of which is transient, but should be drawn from the conformation.

There is scarcely any being which has a simple character, or can be recognized by an isolated feature of its conformation: the combination of many such traits is almost always necessary to distinguish a being from the neighbouring ones, which have some but not all of them, or have them combined with others of which the first is destitute; and the more numerous the beings to be discriminated, the more must these traits accumulate: insomuch that, to distinguish from all others an individual being, a complete description of it must enter into its character.

It is to avoid this inconvenience that divisions and subdivisions have been invented. A certain number of neighbouring beings only are compared together, and their particular characters need only to express their differences, which, by the supposition itself, are the less important parts of their conformation. Such a reunion is termed a *genus*.

The same inconvenience would recur in distinguishing genera from each other, were it not that the operation is repeated in collecting the neighbouring genera, so as to form an *order*; the neighbouring orders to form a *class*, &c. Intermediate subdivisions may also be established.

This scaffolding of divisions, the superior of which contain the inferior, is what is

called a *method*. It is, in some respects, a sort of dictionary, in which we proceed from the properties of things to discover their names ; being the reverse of ordinary dictionaries, in which we proceed from the names to obtain a knowledge of the properties.

When the method, however, is good, it does more than teach us names. If the subdivisions have not been established arbitrarily, but are based on the true fundamental relations,—on the essential resemblances of beings, the method is the surest means of reducing the properties of these beings to general rules, of expressing them in the fewest words, and of stamping them on the memory.

To render it such, an assiduous comparison of beings is employed, directed by the principle of the *subordination of characters*, which is itself derived from that of the conditions of existence. All the parts of a being having a mutual correlativeness, some traits of conformation exclude others ; while some, on the contrary, necessitate others : when, therefore, we perceive such or such traits in a being, we can calculate beforehand those which co-exist in it, or those that are incompatible with them. The parts, properties, or the traits of conformation, which have the greatest number of these relations of incompatibility or of co-existence with others, or, in other words, that exercise the most marked influence upon the whole of the being, are what are called *important characters, dominant characters* ; the others are the *subordinate characters*, all varying, however, in degree.

This influence of characters is sometimes determined rationally, by considering the nature of the organ : when this is impracticable, recourse must be had to simple observation ; and a sure means of recognizing the important characters, which is derived from their own nature, is, that they are more constant ; and that in a long series of different beings, approximated according to their degrees of similitude, these characters are the last to vary.

From their influence and from their constancy result equally the rule, which should be preferred for distinguishing grand divisions, and in proportion as we descend to the inferior subdivisions, we can also descend to subordinate and variable characters.

There can only be one perfect method, which is the *natural method*. An arrangement is thus named in which beings of the same genus are placed nearer to each other than to those of all other genera ; the genera of the same order nearer than to those of other orders, and so in succession. This method is the ideal to which Natural History should tend ; for it is evident that, if we can attain it, we shall have the exact and complete expression of all nature. In fact, each being is determined by its resemblance to others, and its differences from them ; and all these relations would be fully given by the arrangement which we have indicated. In a word, the natural method would be the whole science, and each step towards it tends to advance the science to perfection.

Life being the most important of all the properties of beings, and the highest of all characters, it is not surprising that it has been made in all ages the most general principle of distinction ; and that natural beings have always been separated into two immense divisions, the *living* and the *inanimate*.

#### OF LIVING BEINGS, AND OF ORGANIZATION IN GENERAL.

If, in order to obtain a just idea of the essence of life, we consider it in those beings in which its effects are the most simple, we readily perceive that it consists in the

faculty which certain corporeal combinations have, of enduring for a time, and under a determinate form, by incessantly attracting into their composition a part of surrounding substances, and rendering to the elements portions of their own proper substance.

Life, then, is a vortex (*tourbillon*), more or less rapid, more or less complicated, the direction of which is constant, and which always carries along molecules of the same kind, but into which individual molecules are continually entering, and from which they are constantly departing; so that the *form* of a living body is more essential to it than its *matter*.

As long as this movement subsists, the body in which it takes place is *living—it lives*. When it is permanently arrested, the body *dies*. After death, the elements which compose it, abandoned to the ordinary chemical affinities, are not slow to separate, from which, more or less quickly, results the dissolution of the body that had been living. It was then by the vital motion that its dissolution was arrested, and that the elements of the body were temporarily combined.

All living bodies die after a time, the extreme limit of which is determined for each species; and death appears to be a necessary consequence of life, which, by its own action, insensibly alters the structure of the body wherein its functions are exercised, so as to render its continuance impossible.

In fact, the living body undergoes gradual but constant changes during the whole term of its existence. It increases first in dimensions, according to the proportions and within the limits fixed for each species, and for each of its several parts; then it augments in density, in most of its parts:—it is this second kind of change that appears to be the cause of natural death.

On examining the various living bodies more closely, a common structure is discerned, which a little reflection soon causes us to adjudge as essential to a vortex, such as the vital motion.

Solids, it is evident, are necessary to these bodies for the maintenance of their forms, and fluids for the conservation of motion in them. Their tissue, then, is composed of interlacement and network, or of fibres and solid laminæ, which inclose the liquids in their interstices: it is in these liquids that the motion is most continual and most extended; the extraneous substances penetrate the intimate tissue of bodies in incorporating with them; they nourish the solids by interposing their molecules, and also detach from them their superfluous molecules: it is in a liquid or gaseous form that the matters to be exhaled traverse the pores of the living body; but, in return, it is the solids which contain these fluids, and by their contraction communicate to them a part of their motion.

This mutual action of the solids and fluids, this passage of molecules from one to the other, necessitated considerable affinity in their chemical composition; and, accordingly, the solids of organized bodies are in great part composed of elements easily convertible into liquids or gases.

The motion of the fluids, requiring also a continually repeated action on the part of the solids, and communicating one to them, demanded of the latter both flexibility and dilatability; and hence we find this character nearly general in all organized solids.

This fundamental structure, common to all living bodies—this areolar tissue, the more

or less flexible fibres or laminæ of which intercept fluids more or less abundant—constitutes what is termed the *organization*; and, as a consequence of what we have said, it follows that only organized bodies can enjoy life.

Organization, then, results from a great number of dispositions or arrangements, which are all conditions of life; and it is easy to conceive that the general movement of the life would be arrested, if its effect be to alter either of these conditions, so as to arrest even one of the partial motions of which it is composed.

Every organized body, besides the qualities common to its tissue, has one proper form, not only in general and externally, but also in the detail of the structure of each of its parts; and it is upon this form, which determines the particular direction of each of the partial movements that take place in it, that depends the complication of the general movement of its life, which constitutes its species, and renders it what it is. Each part concurs in this general movement by a peculiar action, and experiences from it particular effects; so that, in every being, the life is a whole, resulting from the mutual action and reaction of all its parts.

Life, then, in general, presupposes organization in general, and the life proper to each being presupposes the organization peculiar to that being, just as the movement of a clock presupposes the clock; and, accordingly, we behold life only in beings that are organized and formed to enjoy it; and all the efforts of philosophers have not yet been able to discover matter in the act of organization, either of itself or by any extrinsic cause. In fact, life exercising upon the elements which at every instant form part of the living body, and upon those which it attracts to it, an action contrary to that which would be produced without it by the usual chemical affinities, it is inconsistent to suppose that it can itself be produced by these affinities, and yet we know of no other power in nature capable of reuniting previously separated molecules.

The birth of organized beings is, therefore, the greatest mystery of the organic economy and of all nature: we see them developed, but never being formed; nay, more, all those of which we can trace the origin, have at first been attached to a body of the same form as their own, but which was developed before them;—in one word, to a *parent*. So long as the offspring has no independent life, but participates in that of its parent, it is called a *germ*.

The place to which the germ is attached, and the occasional cause which detaches it, and gives it an independent life, vary; but the primitive adherence to a similar being is a rule without exception. The separation of the germ is what is designated *generation*.

All organized beings produce similar ones; otherwise, death being a necessary consequence of life, their species would not endure.

Organized beings have even the faculty of reproducing, in degrees varying with the species, certain of their parts of which they may have been deprived. This has been named the power of *reproduction*.

The development of organized beings is more or less rapid, and more or less extended, according as circumstances are differently favourable. Heat, the supply and quality of nourishment, with other causes, exert great influence; and this influence may extend to the whole body in general, or to certain organs in particular:—hence the similitude of offspring to their parents can never be complete.

Differences of this kind, between organized beings, are what are termed *varieties*.

There is no proof that all the differences which now distinguish organized beings are such as may have been produced by circumstances. All that has been advanced upon this subject is hypothetical: experience seems to show, on the contrary, that, in the actual state of things, varieties are confined within rather narrow limits; and, so far as we can retrace antiquity, we perceive that these limits were the same as at present.

We are then obliged to admit of certain forms, which, since the origin of things, have been perpetuated without exceeding these limits; and all the beings appertaining to one of these forms constitute what is termed a *species*. Varieties are accidental subdivisions of species.

Generation being the only means of ascertaining the limits to which varieties may extend, species should be defined *the reunion of individuals descended one from the other, or from common parents, or from such as resemble them as closely as they resemble each other*; but, although this definition is rigorous, it will be seen that its application to particular individuals may be very difficult when the necessary experiments have not been made.\*

To recapitulate,—absorption, assimilation, exhalation, developement, and generation, are the functions common to all living beings; birth and death, the universal limits of their existence; a porous, contractile tissue, containing within its laminæ liquids or gases in motion, the general essence of their structure; substances almost all susceptible of being converted into liquids or gases, and combinations capable of easy transformation into one another, the basis of their chemical composition. Fixed forms, and which are perpetuated by generation, distinguish their species, determine the complication of the secondary functions proper to each of them, and assign to them the office they have to fulfil in the grand scheme of the universe. These forms neither produce nor change themselves; the life supposes their existence; it can exist only in organizations already prepared; and the most profound meditations, assisted by the most delicate observations, can penetrate no further than the mystery of the pre-existence of germs.

#### DIVISION OF ORGANIZED BEINGS INTO ANIMALS AND VEGETABLES.

Living or organized beings have been subdivided, from the earliest times, into *animate beings*, or those possessing sense and motion, and *inanimate beings*, which enjoy

\* That insurmountable difficulties oppose the rigid determination of species, and, consequently, render even the definition of the term impossible, except in a very vague and loose manner, will readily appear on consideration of some of the phenomena presented. The prevalent idea is, that a *species* consists of the aggregate of individuals descended from one original parentage, which alone are supposed to be capable of producing offspring that are prolific *inter se*; and that when individuals, not of the same pristine derivation, interbreed, the hybrids are necessarily *sterile*, which are either quite sterile, or at most can only propagate with individuals of unmixed descent. But it so happens, that every possible grade of approximation is manifested, from the most diverse races, to those which are utterly undistinguishable; while, even in the latter case, urgent analogies, notwithstanding, sometimes forcibly indicate a separateness of origin; as when a series of analogous races inhabiting distant regions are compared together, some of which are obviously different, others doubtfully so, and some apparently identical. And it remains to be shown whether such intimately allied races are some of them, even if not descended from a common stock, (which of course cannot be

ascertained), would not produce hybrids capable of transmitting and perpetuating the mingled breed. It is true that Cuvier guards against this contingency, in the wording of his definition; and that most naturalists would concur in regarding such miscible races, however dissimilar, as *varieties* merely of the same; but a question arises, whether there be not *different degrees* of fertility in hybrids, corresponding to the amount of *affinity*, or physiological accordancy, subsisting betwixt the parent races; it being only within a certain sphere of that affinity that they can be produced at all: besides which, as hybrids are seldom exactly intermediate, and in some instances (particularly among multiparous races) have been known to resemble entirely one or the other parent, it may be presumed that this circumstance would also materially affect their capability of propagation. Experiments are needed to solve this important problem, though there is every reason to suspect that the following proposition will eventually gain the general assent of naturalists, viz., that *while considerable dissimilarity does not of necessity imply specific identity, the converse equally holds, that absolute resemblance falls of itself to constitute specific identity.*—Ed.

neither the one nor the other of these faculties, but are reduced to the simple function of vegetating. Although many plants retract their leaves when touched, and the roots direct themselves constantly towards moisture, the leaves towards air and light, and though some parts of vegetables appear even to exhibit oscillations without any perceptible external cause, still these various movements bear too little resemblance to those of animals to enable us to recognize in them any proofs of perception or of will.

The spontaneity of the movements of animals required essential modifications, even in their simply vegetative organs. Their roots not penetrating the ground, it was necessary that they should be able to place within themselves provisions of food, and to carry its reservoir along with them. Hence is derived the first character of animals, or their alimentary cavity, from which their nutritive fluid penetrates all other parts through pores or vessels, which are a sort of internal roots.

The organization of this cavity and of its appurtenances required varying, according to the nature of the aliment, and the operations which it had to undergo before it could furnish juices proper for absorption : whilst the atmosphere and the earth supply to vegetables only juices ready prepared, and which can be absorbed immediately.

The animal body, which abounds with functions more numerous and more varied than in the plant, required in consequence to have an organization much more complicated ; besides which, its parts not being capable of preserving a fixed relative position, there were no means by which the motion of their fluids could be produced by external causes, as it required to be independent of heat and of the atmosphere : from this originates the second character of animals, or their circulatory system, which is less essential than the digestive, since it was unnecessary in the more simple animals.

The animal functions required organic systems, not needed by vegetables, as that of the muscles for voluntary motion, and that of the nerves for sensibility ; and these two systems, like the rest, acting only through the motions and transformations of the fluids, it was necessary that these should be more numerous in animals, and that the chemical composition of the animal body should be more complicated than that of the plant : and so it is, for an additional substance (azote) enters into it as an essential element, while in plants it is a mere accidental junction with the three other general elements of organization,—oxygen, hydrogen, and carbon. This then is the third character of animals.

The soil and the atmosphere supply to vegetables water for their nutrition, which is composed of oxygen and hydrogen, air, which contains oxygen and azote, and carbonic acid, which is a combination of oxygen and carbon. To extract from these aliments their proper composition, it was necessary that they should retain the hydrogen and carbon, exhale the superfluous oxygen, and absorb little or no azote. Such, then, is the process of vegetable life, of which the essential function is the exhalation of oxygen, which is effected through the agency of light.

Animals in addition derive nourishment, more or less immediately, from the vegetable itself, of which hydrogen and carbon form the principal constituents. To assimilate them to their own composition, they must get rid of the superfluous hydrogen, and especially of the superabundant carbon, and accumulate more azote ; this it is which is performed in respiration, by means of the oxygen of the atmosphere combining with the hydrogen and carbon of the blood, and being exhaled with them under the form of

water and carbonic acid. The azote, whatever part of their body it may penetrate, appears to remain there.

The relations of vegetables and animals with the atmosphere are then inverse; the former retain (*défont*) water and [decompose] carbonic acid, while the latter reproduce them. Respiration is the function essential to the constitution of an animal body; it is that which in a manner animalizes it; and we shall see that animals exercise their peculiar functions more completely, according as they enjoy greater powers of respiration. It is in this difference of relations that the fourth character of animals consists.

OF THE FORMS PECULIAR TO THE ORGANIC ELEMENTS OF THE ANIMAL BODY, AND OF  
THE PRINCIPAL COMBINATIONS OF ITS CHEMICAL ELEMENTS.

An areolar tissue and three chemical elements are essential to every living body, a fourth element being peculiar to that of animals; but this tissue is composed of variously formed meshes, and these elements are united in different combinations.

There are three kinds of organic materials, or forms of tissue,—the *cellular membrane*, the *muscular fibre*, and the *medullary matter*; and to each form belongs a peculiar combination of chemical elements, together with a particular function.

The *cellular membrane* is composed of an infinity of small laminae, fortuitously disposed, so as to form little cells that communicate with each other. It is a sort of sponge, which has the same form as the entire body, all other parts of which fill or traverse it. Its property is to contract indefinitely when the causes which sustain its extension cease to operate. It is this force that retains the body in a given form, and within determined limits.

When condensed, this substance forms those more or less extended laminae which are called *membranes*; the membranes, rolled into cylinders, compose those tubes, more or less ramified, which are termed *vessels*; the filaments, named *fibres*, resolve themselves into it; and the *bones* are nothing but the same, indurated by the accumulation of earthy particles.

The cellular substance consists of that combination [isinglass] which bears the name of *gelatine*, and the character of which is to dissolve in boiling water, and to assume the form, when cold, of a trembling jelly.

The *medullary matter* has not yet been reduced to its organic molecules: it appears to the naked eye as a sort of soft *bouillie* [pultaceous mass], consisting of excessively small globules; it is not susceptible of any apparent motion, but in it resides the admirable power of transmitting to the  $\mu\epsilon$  the impressions of the external senses, and of conveying to the muscles the mandates of the will. The brain and the spinal chord are chiefly composed of it; and the nerves, which are distributed to all the sentient organs, are, essentially, but ramifications of the same.

The *fleshy* or *muscular fibre* is a peculiar sort of filament, the distinctive property of which, during life, is that of contracting when touched or struck, or when it experiences, through the medium of the nerves, the action of the will.

The muscles, immediate organs of voluntary motion, are merely bundles of fleshy fibres. All the membranes, all the vessels which need to exercise any compression, are furnished with these fibres. They are always intimately connected with nervous threads; but those which subserve the purely vegetative functions contract without



the knowledge of the *will*, so that the *will* is indeed one means of causing the fibres to act, but which is neither general nor exclusive.

The fleshy fibre has for its base a particular substance termed *fibrine*, which is insoluble in boiling water, and of which the nature appears to be to take of itself this filamentous form.

The *nutritive fluid*, or the *blood*, such as we find in the vessels of the circulation, not only resolves itself principally into the general elements of the animal body,—carbon, hydrogen, oxygen, and azote, but it also contains fibrine and gelatine, all but disposed to contract, and to assume the forms of membranes or of filaments peculiar to them; nought being ever acquired for their manifestation but a little repose. The blood presents also another combination, which occurs in many animal solids and fluids, namely, *albumen* [or *white of egg*], the characteristic property of which is to coagulate in boiling water. Besides these, the blood contains almost all the elements which may enter into the composition of the body of each animal, such as the lime and phosphorus, which hardens the bones of vertebrated animals, the iron, which colours the blood itself as well as various other parts, the fat or animal oil, which is deposited in the cellular substance to maintain it, &c. All the fluids and solids of the animal body are composed of chemical elements contained in the blood; and it is only by possessing some elements more or less, or in different proportions, that each is severally distinguished; whence it becomes apparent that their formation entirely depends on the subtraction of the whole or part of one or more elements of the blood, and, in some few cases, on the addition of some element from elsewhere.

The various operations, by which the blood supplies nourishment to the solid or liquid matter of all parts of the body, may take the general name of *secretion*. This term, however, is often exclusively appropriated to the production of liquids, while that of *nutrition* is applied more especially to the production and deposition of the matter necessary to the growth and conservation of the solids.

Every solid organ, as well as fluid, has the composition most appropriate for the office which it has to perform, and it preserves it so long as health continues, because the blood renews it as fast as it becomes changed. The blood itself, by this continual contribution, is altered every moment; but is restored by digestion, which renews its matter; by respiration, which sets free the superfluous carbon and hydrogen; and by perspiration and various other excretions, that relieve it from other superabundant principles.

These perpetual changes of chemical composition constitute part of the vital vortex, not less essential than the visible movements and those of translation: the object, indeed, of these latter is simply to produce the former.

#### OF THE FORCES WHICH ACT IN THE ANIMAL BODY.

The muscular fibre is not only the organ of voluntary motion; we have seen that it is also the most powerful of the means employed by nature to effect the movements of translation necessary to vegetative life. Thus the fibres of the intestines produce the peristaltic motion, which causes the aliment to pass onward along this canal; the fibres of the heart and arteries are the agents of the circulation, and, through it, of all the secretions, &c.

The will causes the fibre to contract through the medium of the nerve; and the involuntary fibres, such as those we have mentioned, are equally animated by the nerves which pervade them; it is, therefore, probable, that these nerves are the cause of their contraction.

All contraction, and, generally speaking, all change of dimension in nature, is produced by a change of chemical composition, though it consists merely in the flowing or ebbing of an imponderable\*, such as caloric; it is thus also that the most violent of known movements are occasioned, as combustions, detonations, &c.

There is, then, great reason for supposing that it is by an imponderable fluid that the nerve acts upon the fibre; and the more especially, as it is demonstrated that this action is not mechanical.

The medullary matter of the whole nervous system is homogeneous, and must exercise, wherever it is found, the functions appertaining to its nature; all its ramifications receive a great abundance of blood-vessels.

All the animal fluids being derived from the blood by secretion, it cannot be doubted that the same holds with the nervous fluid, nor that the medullary matter secretes [or evolves] it.

On the other hand, it is certain that the medullary matter is the sole conductor of the nervous fluid; and that all the other organic elements serve as non-conductors, and arrest it, as glass arrests electricity.

The external causes which are capable of producing sensations, or of occasioning contractions in the fibre, are all chemical agents, capable of effecting decompositions, such as light, caloric, the salts, odorous vapours, percussion, compression, &c.

It would seem, then, that these causes act upon the nervous fluid chemically, and by changing its composition: which appears the more likely, as their action becomes weakened by continuance, as if the nervous fluid needed to resume its primitive composition in order to be altered anew.

The external organs of sense may be compared to sieves, which allow nothing to pass through to the nerve except the species of agent which should affect it in that particular place, but which often accumulates so as to increase the effect. The tongue has its spongy papillæ, which imbibe saline solutions: the ear a gelatinous pulp, which is intensely agitated by sonorous vibrations; the eye transparent lenses, which concentrate the rays of light, &c.

It is probable that what are styled irritants, or the agents which occasion the contractions of the fibre, exert this action by producing on the fibre, by the nerve, the same effect which is produced by the will; that is to say, by altering the nervous fluid in the manner necessary to change the dimensions of the fibre on which it has influence; but the will has nothing to do in this action; the *mx* is often even without any knowledge of it. The muscles separated from the body are still susceptible of irritation, so long as the portion of the nerve distributed within them preserves its power of acting on them; the will being evidently unconnected with this phenomenon.

The nervous fluid is altered by muscular irritation, as well as by sensation and voluntary motion; and the same necessity occurs for the re-establishment of its primitive composition.

The movements of translation necessary to vegetative life are determined by irritants:

\* "Imponderable fluid" is the expression in the original.—Ed.

the aliment irritates [or excites] the intestine, the blood irritates the heart, &c. These movements are all independent of the will, and in general (while health endures) take place without the cognizance of the *mæ*; the nerves which produce them have even, in several parts, a different distribution from that of the nerves affected by sensations or subject to the will, and the object of the difference appears to be the securing of this independence.\*

The nervous functions, that is to say, sensitiveness and muscular irritability, are so much the stronger at every point, in proportion as the exciting cause is more abundant; and as this agent, or the nervous fluid, is produced by secretion [or evolution], its abundance must be in proportion to the quantity of medullary or secretory matter, and the amount of blood received by the latter.

In animals that have a circulation, the blood is propelled through the arteries which convey it to its destined parts, by means of their irritability and that of the heart. If these arteries be irritated, they act more vigorously, and propel a greater quantity of blood; the nervous fluid becomes more abundant, and augments the local sensibility; this, in its turn, increases the irritability of the arteries, so that this mutual action may be carried to a great extent. It is termed *orgasm*, and when it becomes painful and permanent, *inflammation*. The irritation may also originate in the nerve, when it experiences acute sensations.

This mutual influence of the nerves and fibres, either in the intestinal system, or in the arterial system, is the real spring of vegetative life in animals.

As each external sense is permeable only by particular kinds of sensation, so each internal organ may be accessible only to such or such agent of irritation. Thus, mercury irritates the salivary glands, cantharides excite the bladder, &c. These agents are what are termed *specifics*.

The nervous system being homogeneous and continuous, local sensations and irritation debilitate the whole; and each function, carried too far, may enfeeble the others. Excess of aliment thus weakens the faculty of thought; while prolonged meditation impairs the energy of digestion, &c.

Excessive local irritation will enfeeble the whole body, as if all the powers of life were concentrated on a single point.

A second irritation produced at another point may diminish, or *divert* as it is termed, the first; such is the effect of purgatives, blisters, &c. [denominated counter-irritation].

All rapid as the foregoing enunciation is, it is sufficient to establish the possibility of accounting for all the phenomena of physical life, by the simple admission of a fluid such as we have defined, from the properties which it manifests.†

\* In the above sentence, there are distinctly mentioned the three sorts of nerves, the separate functions of which have been conclusively demonstrated by Sir Charles Bell: viz., nerves of *volition*, which transmit the mandates of the will; of *sensation*, which convey to the sensorium the impressions of the senses; and of *sympathy*, or involuntary movement, the reunion of the ramifications of which in a plexus of knots, or ganglions, is intimated in the text, those of the second class being distinguished by a swelling or ganglion near their base.—Ed.

† The unceasing chemical changes consequent upon vitality must necessarily develop electricity; and that the *nervous fluid* is no other than the *electric*, may be considered as proved by the identity of their phenomena. Indeed, it has long been known that the transmission of voltaic electricity along the nerves of a recently dead animal, suffices to produce the most violent muscular action; but the regulation of that action, its exclusive direction to particular suites of muscles, requires the vital impulse. "If the brain," remarks Sir

John Herschel, " (for which wonderfully constituted organ no other mode of action possessing the least probability has ever been devised), be an electric pile, constantly in action, it may be conceived to discharge itself at regular intervals, when the tension of the electricity developed reaches a certain point, along the nerves which communicate with the heart, and thus to excite the pulsations of that organ. This idea is forcibly suggested by a view of that elegant apparatus, the dry pile of Deline, in which the successive accumulations of electricity are carried off by a suspended ball, which is kept, by the discharges, in a state of regular pulsation for any length of time. We have witnessed the action of such a pile, maintained in this way for whole years, in the study of the above-named eminent philosopher. The same idea of the cause of the pulsation of the heart appears to have occurred to Dr. Arnott, and is mentioned in his useful, and excellent work on *Physics*, to which, however, we are not indebted for the suggestion, it having occurred to us independently many years ago."—*Discourse on the Study of Natural Philosophy*, p. 363.—Ed.

SUMMARY IDEA OF THE FUNCTIONS AND ORGANS OF THE BODIES OF ANIMALS, AND OF THEIR VARIOUS DEGREES OF COMPLICATION.

After what we have stated respecting the organic elements of the body, its chemical principles, and the forces which act within it, it remains only to give a summary idea in detail of the functions of which life is composed, and of their respective organs.

The functions of the animal body are divided into two classes :—

The animal functions, or those proper to animals,—that is to say, sensibility and voluntary motion.

The vital, vegetative functions, or those common to animals and vegetables; that is to say, nutrition and generation.

Sensibility resides in the nervous system.

The most general external sense is that of touch; its seat is in the skin, a membrane enveloping the whole body, and traversed all over by nerves, of which the extreme filaments expand on the surface into papillæ, and are protected by the epidermis, and by other insensible teguments, such as hairs, scales, &c. Taste and smell are merely delicate states of the sense of touch, for which the skin of the tongue and nostrils is particularly organized; the former by means of papillæ more convex and spongy; the latter, by its extreme delicacy and the multiplication of its ever humid surface. We have already spoken of the eye and ear in general. The organ of generation is endowed with a sixth sense, which is seated in its internal skin; that of the stomach and intestines declares the state of those viscera by peculiar sensations. In fine, sensations more or less painful may originate in all parts of the body through accidents or diseases.

Many animals have neither ears nor nostrils; several are without eyes, and some are reduced to the single sense of touch, which is never absent.

The action received by the external organs is continued through the nerves to the central masses of the nervous system, which, in the higher animals, consists of the brain and spinal chord. The more elevated the nature of the animal, the more voluminous is the brain, and the more the sensitive power is concentrated there; in proportion as the animal is placed lower in the scale, the medullary masses are dispersed, and in the lowest genera of all, the nervous substance appears to merge altogether, and blend in the general matter of the body.

That part of the body which contains the brain and the principal organs of sense, is called the head.

When the animal has received a sensation, and which has induced in it an act of volition, it is by [particular] nerves also that this volition is transmitted to the muscles.

The muscles are bundles of fleshy fibres, the contractions of which produce all the movements of the animal body. The extensions of the limbs, and all the lengthenings of parts, are the effect of muscular contractions, equally with flexions and abbreviations. The muscles of each animal are disposed in number and direction according to the movements which it has to execute; and when these movements require to be effected with some vigour, the muscles are inserted into hard parts, articulated one over another, and may be considered as so many levers. These parts are called bones in

the vertebrated animals, where they are internal, and formed of a gelatinous mass, penetrated with molecules of phosphate of lime. In mollusks, crustaceans, and insects, where they are external, and composed of a calcareous or corneous substance that exudes between the skin and epidermis, they are termed shells, crusts, and scales.

The fleshy fibres are attached to the hard parts by means of other fibres of a gelatinous nature, which seem to be a continuation of the former, constituting what are called tendons.

The configuration of the articulating surfaces of the hard parts limits their movements, which are further restrained by cords or envelopes attached to the sides of the articulations, and which are termed ligaments.

It is from the various dispositions of this bony and muscular apparatus, and from the form and proportions of the members which result therefrom, that animals are capable of executing those innumerable movements which enter into walking, leaping, flight, and swimming.

The muscular fibres appropriated to digestion and circulation are independent of the will; they receive nerves, however, but, as we have said, the chief of them exhibit subdivisions and enlargements which appear to have for their object the estrangement of the empire of the *mæ*. It is only in paroxysms of the passions and other powerful mental emotions, which break down these barriers, that the empire of the *mæ* becomes perceptible; and even then its effect is almost always to disorder these vegetative functions. It is also in a state of sickness only that these functions are accompanied by sensations. Digestion is ordinarily performed unconsciously.

The aliment, divided by the jaws and teeth, or sucked up when liquids constitute the food, is swallowed by the muscular movements of the back part of the mouth and throat, and deposited in the first portion of the alimentary canal, usually expanded into one or more stomachs; it there is penetrated with juices proper to dissolve it. Conducted thence along the rest of the canal, it receives other juices destined to complete its preparation. The parietes of the canal have pores which extract from this alimentary mass its nutritious portion, and the useless residue is rejected as excrement.

The canal in which this first act of nutrition is performed, is a continuation of the skin, and is composed of similar layers; even the fibres which encircle it are analogous to those which adhere to the internal surface of the skin, called the fleshy pannicle. Throughout the whole interior of this canal there is a transudation, which has some connexion with the cutaneous perspiration, and which becomes more abundant when the latter is suppressed; the skin even exercises an absorption very analogous to that of the intestines.

It is only in the lowest animals that the excrements are rejected by the mouth, and in which the intestine has the form of a sac without issue.

Among those even in which the intestinal canal has two orifices, there are many in which the nutritive juices, absorbed by the coats of the intestine, are immediately diffused over the whole spongy substance of the body: this appears to be the case with the whole class of insects.

But, ascending from the arachnides and worms, the nutritive fluids circulate in a system of confined vessels, the ultimate ramifications of which alone dispense its molecules to the parts that are nourished by it; those particular vessels which convey it are named

*arteries*, and those which bring it back to the centre of the circulation are termed *veins*. The circulating vortex is sometimes simple, sometimes double, and even triple (including that of the *vena porta*); the rapidity of its movements is often aided by the contractions of a certain fleshy apparatus denominated *hearts*, and which are placed at one or the other centres of circulation, and sometimes at both of them.

In the red-blooded vertebrated animals, the nutritive fluid exudes white or transparent from the intestines, and is then termed *chyle*; it is poured by particular vessels, named *lacteals*, into the venous system, where it mingles with the blood. Vessels resembling these lacteals, and forming with them what is known as the lymphatic system, also convey to the venous blood the residue of the nutrition of the parts and the products of cutaneous absorption.

Before the blood is proper to nourish the several parts, it must experience from the ambient element, by respiration, the modification of which we have already spoken. In animals which have a circulation, a portion of the vessels is destined to carry the blood into organs, where they spread over an extensive surface, that the action of the ambient element might be increased. When this element [or medium] is the air, the surface is hollow, and is called *lungs*; when water, it is salient, and termed *gills*.\* There are always motive organs disposed for propelling the ambient element into, or upon, the respiratory organ.

In animals which have no circulation, the air is diffused through every part of the body by elastic vessels, named *tracheæ*; or water acts upon them, either by penetrating through vessels, or by simply bathing the surface of the skin.

The blood which is respired is qualified for restoring the composition of all the parts, and to effect what is properly called nutrition. It is a great marvel that, with this facility which it has of becoming decomposed at each point, it should leave precisely the species of molecule which is there necessary; but it is this wonder which constitutes the whole vegetative life. For the nourishment of the solids, we see no other arrangement than a great subdivision of the extreme arterial ramifications; but for the production of liquids, the apparatus is more complex and various. Sometimes the extremities of the vessels simply spread over large surfaces, whence the produced fluid exudes; sometimes it oozes from the bottom of little cavities. Very often, before these arterial extremities change into veins, they give rise to particular vessels that convey this fluid, which appears to proceed from the exact point of union between the two kinds of vessels; in this case, the blood-vessels and these latter termed *especial*, form, by their interlacement, the bodies called *conglomerate* or *secretory glands*.

In animals that have no circulation, and particularly insects, the nutritive fluid bathes all the parts; each of them draws from it the molecules necessary for its sustenance: if it be necessary that some liquid be produced, the appropriate vessels float in the nutritive fluid, and imbibe from it, by means of their pores, the constituent elements of that liquid.

It is thus that the blood incessantly supports all the parts, and repairs the alterations which are the continual and necessary consequence of their functions. The

\* It may be remarked here, that, in strictness of language, no animal respire water, but the air which is suspended in water, and which has been ascertained to contain more oxygen than that of the free atmosphere. The elements of water, it should be remembered, are chemically combined, while those of air are only mechanically mixed. To obtain oxygen from the one, therefore, decomposition is required; from the other, no disunion. The only distinction, then, in the

respiration of animals is, that some breathe the free air, and are supplied with lungs, and others that diffused in water, and have therefore gills: but even this difference, however, is more apparent than real, as in all cases the respiratory surface requires to be moist or wet, in order to perform its function. Deprive water of its air by boiling it, and it cannot support life.—Ed.

general ideas which we form respecting this process are tolerably clear, although we have no distinct or detailed notion of what passes at each point; and for want of knowing the chemical composition of each part with sufficient precision, we cannot render an exact account of the transformations necessary to produce it.

Besides the glands which separate from the blood those fluids which perform some office in the internal economy, there are some which detach others from it that are to be totally rejected, either simply as superfluities, such as the urine, which is produced by the kidneys, or for some use to the animal, as the ink of the cuttle, and the purple matter of various other mollusks, &c.

With respect to generation, there is one process or phenomenon infinitely more difficult to conceive than that of the secretions; it is the production of the germ. We have seen even that it may be regarded as little less than incomprehensible; but, the existence of the germ once admitted, generation presents no particular difficulty: so long as it adheres to the parent, it is nourished as if it were one of its organs\*; and when it detaches itself, it has its own proper life, which is essentially similar to that of the adult.

The germ, the embryo, the foetus, and the new-born animal, have in no instance, however, precisely the same form as the adult, and the difference is sometimes so great, that their assimilation merits the name of *metamorphosis*. Thus, no one not previously aware of the fact, would suppose that the caterpillar is to become a butterfly.

All living beings are more or less metamorphosed in the course of their growth, that is to say, they lose certain parts, and develop others. The antennæ, wings, and all the parts of the butterfly were inclosed within the skin of the caterpillar; this skin disappears along with the jaws, feet, and other organs that do not remain in the butterfly. The feet of the frog are inclosed by the skin of the tadpole: and the tadpole, to become a frog, loses its tail, mouth, and gills. The infant likewise, at birth, loses its placenta and envelope; at a certain age its thymous gland almost disappears; and it acquires by degrees its hair, teeth, and beard. The relative size of its organs alters, and its body increases proportionally more than its head, its head more than its internal ear, &c.

The place where these germs are found, the assemblage of them, is named the *ovary*; the canal through which, when detached, they are carried forward, the *oviduct*; the cavity in which, in many species, they are obliged to remain for a longer or shorter period before birth, the *matrix* or *uterus*; the exterior orifice through which they pass into the world, the *vulva*. When there are sexes, the male sex fecundates; the germs appearing in the female. The fecundating liquor is named *semen*; the glands which separate it from the blood, *testicles*; and, when it is necessary that it should be introduced into the body of the female, the intromittent organ is called a *penis*.

#### RAPID EXPOSITION OF THE INTELLECTUAL FUNCTIONS OF ANIMALS.

The impression of external objects on the *me*, the production of a sensation, of an image, is a mystery impenetrable to our intellect; and materialism an hypothesis, so much the more conjectural, as philosophy can furnish no direct proof of the actual

\* Germs have been detected in the ovaria of a human foetus.—En.

existence of matter. But the naturalist should examine what appear to be the material conditions of sensation; he should trace the ulterior operations of the mind, ascertain to what point they reach in each being, and assure himself whether they are not subject to conditions of perfection, dependent on the organization of each species, or on the momentary state of each individual body.

For the *mē* to perceive, there must be an uninterrupted nervous communication between the external sense and the central masses of the medullary system. Hence it is only when a modification is experienced by these masses that the *mē* perceives: there may also be real sensations, without the external organ being affected, and which originate either, in the nervous passage, or in the central mass itself; such are dreams and visions, or certain accidental sensations.

By central masses, we mean a part of the nervous system, which is more circumscribed as the animal is more perfect. In man, it consists exclusively of a limited portion of the brain; but in reptiles, it includes the brain and the whole of the medulla, and each of their parts taken separately; so that the absence of the entire brain does not prevent sensation. In the inferior classes this extension is still greater.

The perception acquired by the *mē*, produces the image of the sensation experienced. We trace to without the cause of that sensation, and thus acquire the *idea* of the object which produces it. By a necessary law of our intelligence, all the ideas of material objects are in time and space.

The modifications experienced by the medullary masses leave impressions there, which are reproduced, and recall to mind images and ideas; this is *memory*, a corporeal faculty that varies considerably, according to age and health.

Ideas that are similar, or which have been acquired at the same time, recall each other; this is the *association of ideas*. The order, extent, and promptitude of this association constitute the perfection of memory.

Each object presents itself to the memory with all its qualities, or with all its accessory ideas.

*Intellect* has the power of separating these accessory ideas of objects, and of combining those that are alike in several different objects under one *general idea*, the prototype of which nowhere really exists, nor presents itself in an isolated form; this is *abstraction*.

Every sensation being more or less agreeable or disagreeable, experience and repeated essays show promptly what movements are required to procure the one and avoid the other; and with respect to this, the intellect abstracts itself from general rules to direct the will.

An agreeable sensation being liable to consequences that are not so, and *vice versa*, the subsequent sensations become associated with the idea of the primitive one, and modify the general rules abstracted by the intellect; this is *prudence*.

From the application of rules to general ideas, result certain formulæ, which are afterwards adapted easily to particular cases; this is called *reasoning—ratiocination*.

A lively remembrance of primitive and associated sensations, and of the impressions of pleasure and pain that attach to them, constitutes *imagination*.

One privileged being, *MAN*, has the faculty of associating his general ideas with particular images more or less arbitrary, easily impressed upon the memory, and which serve to recall the general ideas which they represent. These associated images are



what are called *signs*; their assemblage is a *language*. When the language is composed of images that relate to the sense of hearing or *sound*, it is termed *speech*. When its images relate to that of sight, they are called *hieroglyphics*. *Writing* is a suite of images that relate to the sense of sight, by which we represent elementary sounds; and, in combining them, all the images relative to the sense of hearing of which speech is composed: it is, therefore, only a mediate representation of ideas.

This faculty of representing general ideas by particular signs or images associated with them, enables us to retain distinctly in the memory, and to recall without confusion, an immense number, and furnishes to the reasoning faculty and the imagination innumerable materials, and to individuals the means of communication, which cause the whole species to participate in the experience of each individual; so that no bounds seem to be placed to the acquisition of knowledge: this is the distinctive character of human intelligence.\*

The most perfect animals are infinitely below man in their intellectual faculties; but it is, nevertheless, certain that their intelligence performs operations of the same kind. They move in consequence of sensations received, are susceptible of durable affections, and acquire by experience a certain knowledge of things, by which they are governed independently of actual pain and pleasure, and by the simple foresight of consequences.† When domesticated, they feel their subordination, know that the being who punishes them may refrain from doing so if he will, and when sensible of having done wrong, or behold him angry, they assume a suppliant air. In the society of man they become either corrupted or improved, and are susceptible of emulation and jealousy: they have among themselves a natural language, which, it is true, expresses only their momentary sensations; but man teaches them to understand another, much more complicated, by which he makes known to them his will, and causes them to *execute it*.

In short, we perceive in the higher animals a certain degree of reason, with all its consequences, good and bad, and which appears to be about the same as that of children before they have learned to speak. In proportion as we descend to the animals more removed from man, these faculties become enfeebled; and, in the lowest classes, we find them reduced to signs, at times equivocal only, of sensibility, that is to say, to a few slight movements to escape from pain. Between these two extremes, the degrees are endless.

In a great number of animals, however, there exists a different faculty of intelligence, which is named *instinct*. This prompts them to certain actions necessary to the preservation of the species, but often altogether foreign to the apparent wants of individuals; frequently, also, very complicated, and which, to be ascribed to intelligence, would suppose a foresight and knowledge in the species that execute them infinitely superior to what can be admitted. These actions, the result of instinct, are not the effect of imitation, for the individuals that perform them have often never seen them performed by others: they are not proportioned to the ordinary intelligence, but become more singular, more wise, more disinterested, in proportion as the animals belong to less elevated classes, and are, in all the rest of their actions, more dull and

\* Linnaeus defined the human being to be a "self-knowing animal;" which is a bold assumption, taken either way.—Ed.

† That is to say, they obviously remark coincidences and sequences;

but it is doubtful whether any of them can mentally trace remote causes, and the complication of phenomena. It is with man in his least civilized state that they should be compared.—Ed.

stupid. They are so truly the property of the species, that all its individuals perform them in the same way, without any improvement.

Thus the working bees have always constructed very ingenious edifices, agreeably to the rules of the highest geometry, and destined to lodge and nourish a posterity not even their own. The wasps and the solitary bees also form very complicated nests, in which to deposit their eggs. From this egg issues a grub, which has never seen its parent, which is ignorant of the structure of the prison in which it is confined, but which, once metamorphosed, constructs another precisely similar.

In order to have a clear idea of instinct, it is necessary to admit that these animals have innate and perpetual images or sensations in the sensorium, which induce them to act as ordinary and accidental sensations commonly do. It is a sort of dream or vision that ever haunts them, and may be considered, in all that relates to instinct, as a kind of somnambulism.

Instinct has been granted to animals as a supplement for intelligence, to concur with it, and with force and fecundity, to the preservation, in a proper degree, of each species.

There is no visible mark of instinct in the conformation of the animal; but intelligence, so far as has been observed, is in constant proportion to the relative size of the brain, and particularly of its hemispheres.\*

#### OF METHOD, AS APPLIED TO THE ANIMAL KINGDOM.

After what we have said respecting methods in general, there remains to ascertain which are the most influential characters of animals, that should serve as the basis of their primary divisions. It is evident they should be those which are drawn from the animal functions; that is to say, from the sensations and movements; for not only do both these make the being an animal, but they establish, in a manner, its degree of animality.

Observation confirms this position, by showing that their degrees of development and complication accord with those of the organs of the vegetative functions.

The heart and the organs of the circulation form a kind of centre for the vegetative functions, as the brain and trunk of the nervous system do for the animal

\* One of the most curious phenomena of instinct is the transmission of instilled habits by generation, as in the instance of "high-bred pointer and setter dogs, often requiring no training to fit them for their particular modes of indicating game. Propensities are similarly hereditary in the human species; but innate knowledge, as a substitute for individually acquired experience, is peculiar to brutes, which, for the most part, are thrown upon their own resources, before they have had time or opportunities to gain the necessary information to serve as a guide for the regulation of their conduct. All the higher animals, except the human species, appear to recognize their natural foes intuitively, to know even where their hidden weapons lie, also where they (and likewise themselves) are most vulnerable, and they endeavour to use their own peculiar weapons before these are developed. If incapable of resistance, they commonly have recourse to stratagem; thus a brood of newly-hatched partridges will instantly cower motionless at sight of an object of distrust, the intent of which must be, that the close similarity of their colour to that of the surface should cause them to be overlooked. Predatory animals, again, which immolate victims capable of dangerous resistance, instinctively endeavour always to attack a vital part, so as to effect their purpose speedily, and with least hazard to themselves; but those which prey on feeble and defenceless animals attack indiscriminately. Many astonishing manifestations of the instinctive faculty occur respecting the manner in which the food is obtained; and in the ant and some rodent quadrupeds, which store up grain, the embryo of every seed is destroyed, to prevent germination.

The seasonal migrative impulse which recurs in some animals is among the most incomprehensible of instinctive phenomena, as it is shown to be, in various cases, independent of food or temperature; though the latter, in particular, exercises some influence on its development, as does also the state of the sexual organs in spring. The guiding principle of migration is equally mysterious,—that which enables a bird of passage to return periodically to its former haunts, to the same locality (both in winter and summer), which it had previously occupied; and the young also to the place of their nativity. This principle is further evinced in the return of pigeons, &c. to their accustomed place of abode from indefinite distances, and by a straighter and more direct route than that by which they had been removed. It appears, likewise, to be manifested in somnambulism, and, perhaps, in some other affections of the human body; but the sexual and parental instincts are those which are chiefly cognisable in civilized mankind.

One curious fact connected with the migrative propensity is, that the same species is sometimes permanently resident in one locality, and migratory in another. Thus the robin, which is stationary in Britain, leaves Germany in the autumn; which would seem to indicate that the erratic habit may have originated (in this instance) from necessity, and in course of time have become regular and transmissible, independently of external causes. Migratory animals, however, may commonly be distinguished from others of the same genus, by their superior structural powers of locomotion.—Ed.

functions. Now, we see these two systems degrade and disappear together. In the lowest of animals, where the nerves cease to be visible, there are no longer distinct fibres, and the organs of digestion are simply excavated in the homogeneous mass of the body. In insects, the vascular system disappears even before the nervous one; but, in general, the dispersion of the medullary masses accompanies that of the muscular agents: a spinal chord, on which the knots or ganglions represent so many brains, corresponds to a body divided into numerous rings, and supported by pairs of members distributed along its length, &c.

This correspondence of general forms, which results from the arrangement of the organs of motion, the distribution of the nervous masses, and the energy of the circulating system, should serve then for the basis of the primary sections to be made in the animal kingdom. We will afterwards ascertain, in each of these sections, what characters should succeed immediately to these, and form the basis of the primary subdivisions.

#### GENERAL DISTRIBUTION OF THE ANIMAL KINGDOM INTO FOUR GREAT DIVISIONS.

If the animal kingdom be considered with reference to the principles which we have laid down, and, divesting ourselves of the prejudices founded on the divisions formerly admitted, we regard only the organization and nature of animals, and not their size, utility, the more or less knowledge which we have of them, nor any other accessory circumstances, it will be found that there exist four principal forms, four general plans, if it may be thus expressed, on which all animals appear to have been modelled, and the ulterior divisions of which, under whatever title naturalists may have designated them, are merely slight modifications, founded on the development or addition of certain parts, which produce no essential change in the plan itself.

In the first of these forms, which is that of man, and of the animals which most resemble him, the brain and the principal trunk of the nervous system are inclosed in a bony envelope, which is formed by the cranium and the vertebræ: to the sides of this medial column are attached the ribs, and the bones of the limbs, which compose the framework of the body: the muscles generally cover the bones, the motions of which they produce, and the viscera are contained within the head and trunk. Animals of this form we shall denominate

#### VERTEBRATE ANIMALS (*Animalia vertebrata*).

They have all red blood, a muscular heart, a mouth furnished with two jaws, placed one either before or above the other, distinct organs of sight, hearing, smell, and taste, situated in the cavities of the face; never more than four limbs; the sexes always separated; and a very similar distribution of the medullary masses, and of the principal branches of the nervous system.

On examining each of the parts of this great series of animals more closely, there may always be detected some analogy, even in those species which are most remote from one another; and the gradations of one single plan may be traced from man to the last of fishes.

In the second form there is no skeleton; the muscles are attached only to the skin,

which constitutes a soft, contractile envelope, in which, in many species, are formed stony plates, called shells, the production and position of which are analogous to that of the mucons body; the nervous system is contained within this general envelope, together with the viscera, and is composed of several scattered masses, connected by nervous filaments, and of which the principal, placed over the œsophagus, bears the name of brain. Of the four senses, the organs of those of taste and vision only can be distinguished; the latter of which are even frequently wanting. A single family alone presents organs of hearing. There is always, however, a complete system of circulation, and particular organs for respiration. Those of digestion and of the secretions are little less complicated than in the vertebrated animals. We will distinguish the animals of this second form by the appellation of

#### MOLLUSCOUS ANIMALS (*Animalia mollusca*).

Although the general plan of their organization is not so uniform, as regards the external configuration of the parts, as that of the vertebrates, there is always an equal degree of resemblance between them in the essential structure and the functions.

The third form is that observed in insects, worms, &c. Their nervous system consists of two long chords running longitudinally through the abdomen, dilated at intervals into knots or ganglions. The first of these knots, placed over the œsophagus, and called brain, is scarcely any larger than those which are along the abdomen, with which it communicates by filaments that encircle the œsophagus like a collar. The envelope of their trunk is divided by transverse folds into a certain number of rings, of which the teguments are sometimes hard, sometimes soft, but to the interior of which the muscles are always attached. The trunk often bears on its sides articulated limbs, but is frequently unfurnished with them. We will bestow on these animals the term

#### ARTICULATE ANIMALS (*Animalia articulata*).

It is among these that the passage is observed from the circulation in closed vessels, to nutrition by imbibition, and the corresponding transition from respiration in circumscribed organs, to that effected by tracheæ or air-vessels distributed through the body. The organs of taste and vision are the most distinct in them, a single family alone presenting that of hearing. Their jaws, when they have any, are always lateral.

Lastly, the fourth form, which embraces all those animals known under the name of *Zoophytes*, may be designated

#### RADIATE ANIMALS (*Animalia radiata*).

In all the preceding, the organs of sense and motion are arranged symmetrically on the two sides of an axis. There is a posterior and an anterior dissimilar face. In this last division, they are disposed as rays round a centre; and this is the case, even when they consist of but two series, for then the two faces are alike.\* They approximate to the homogeneity of plants, having no very distinct nervous system, nor organs of particular senses; there can scarcely be perceived, in some of them, the vestiges of a

\* M. Agassiz has expressed a different opinion. See *Radiata*.—Ed.

circulation. Their respiratory organs are almost always on the surface of the body; the digestive canals have only a sac without issuing from the whole intestine; and the nervous system presents only a soft homogeneous pulp, endowed with motion and sensibility.

["The necessity," writes Mr. Owen, "for a dismemberment of the *Radiata* of Cuvier, which Rudolphi justly calls a chaotic group†, has been felt, and directly or indirectly expressed, by most naturalists and comparative anatomists.‡ It is impossible, indeed, to predicate a community of structure in either the locomotive, excretive, digestive, sensitive, or generative systems, with respect to this division, as it now stands in the *Règne Animal*. \* \* \*

"Taking the nervous system as a guide, the *Radiata* of Cuvier will be found to resolve themselves into two natural groups, of which the second differs in the absence or obscure traces of nervous filaments from the higher division, in which these are always distinctly traceable, either radiating from an oral ring, or distributed in a parallel longitudinal direction, according to the form of the body.

"These different conditions of the nervous system are accompanied by corresponding modifications of the muscular, digestive, and vascular systems; and a negative character, applicable to the higher division of Cuvier's *Radiata*, may be derived from the generative system."§

It is only in the lower-organized of these divisions, to which the term

#### ACRITE ANIMALS (*Animalia acrita*)

has been applied by Macleay, also that of *Protozoa* and *Oozoa* by Carus (from the circumstance of its members being analogous to the ova or germs of the higher classes), that the alimentary cavity and sanguiferous canals are destitute of proper parietes, being simple excavations or passages in the granular pulp of the body: for in the *Nematoneura* (a name applied to the higher division of Cuvier's *Radiata* by Owen), the digestive organ is provided with a proper muscular tunic, and floats in an abdominal cavity: and those classes which manifest a circulating system distinct from the digestive tube possess vessels with proper parietes, distinguishable into arteries and veins.

No nematoneurous class presents an example of generation by spontaneous fision or gemmation, but these modes of reproduction are common in the acrite division. Some of the latter, however, are oviparous; and in a few the sexes are separate.]

\* Before my time, modern naturalists divided all Invertebrated animals into two classes, the Insects and Worms. I was the first to attack this method, and presented another division, in a Memoir read before the Natural History Society of Paris, on the 10th of May, 1793, and printed in the *Décade Philosophique*, in which I marked the characters and limits of the Mollusks, Crustaceans, Insects, Worms, Echinoderms, and Zoophytes. I distinguished the red-blooded worms, or Annelides, in a memoir read before the Institute on the 31st of December, 1801. And finally, in a Memoir read before the Institute in July, 1813, and printed in the *Annales du Mus. d'Hist. Nat.*, tom. xix., I distributed

these various classes under three grand divisions, each of which is comparable to that of the vertebrate animals.

† *Synopsis Entozoorum*, p. 572.

‡ Lamarck observes:—"The *Apathetic Animals*," (as he terms the *Acrita*), "have been very improperly called *Zoophytes*; as their nature is completely animal, and in no respect vegetable. The denomination of *Rayed Animals* is also objectionable, as it applies only to a portion of them.—*Anim. sans Vertèbres*, l. p. 1....

§ *Cyclopædia of Anatomy and Physiology*, Art. *Acrita*; from which the succeeding passages are also abridged.—Ed.

# FIRST GREAT DIVISION OF THE ANIMAL KINGDOM.

## THE VERTEBRATE ANIMALS.

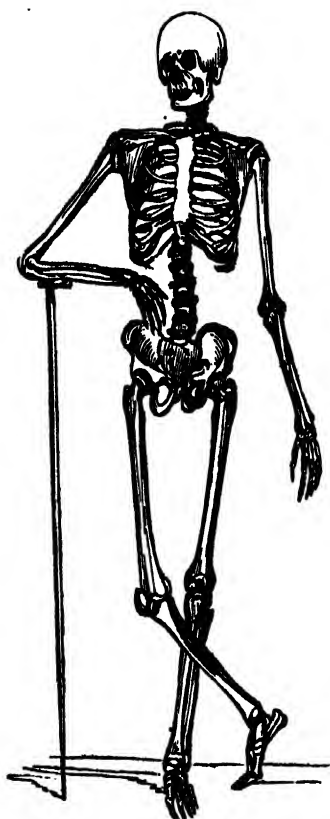


Fig. 1.

THE bodies and limbs of these being supported by a frame-work composed of connected pieces moveable upon each other, they have the more precision and vigour in their movements: the solidity of this support permits of their attaining considerable size, and it is among them that the largest animals are found.

Their more concentrated nervous system, and the greater volume of its central portions, impart more energy and more stability to their sentiments, whence result superior intelligence and perfectibility.

Their body always consists of a head, trunk, and members.

The head is formed by the cranium, which incloses the brain, and by the face, which is composed of the two jaws and the receptacles of the organs of sense.

Their trunk is supported by the spine of the back and the ribs.

The spine is composed of vertebræ moveable upon each other, of which the first supports the head, and which have an annular perforation, forming together a canal, wherein is lodged that medullary production from which the nerves arise, and which is called the spinal marrow.

The spine, most commonly, is continued into a tail, extending beyond the hinder limbs.

The ribs are semicircles, which protect the sides of the cavity of the trunk: they are articulated at one extremity to the vertebræ, and are ordinarily attached in front to the breast-bone; but sometimes they only partly encircle the trunk, and there are genera in which they are hardly visible.

There are never more than two pairs of limbs; but sometimes one or the other is wanting, or even both: their forms vary according to the movements which they have to execute. The anterior limbs may be organized as hands, feet, wings, or fins; the posterior as feet, or instruments for swimming.

The blood is always red, and appears to have a composition proper for sustaining that energy of sentiment and vigour of muscles, but in different degrees, which correspond to the amount of respiration, from which originates the subdivision of the vertebrate animals into four classes.

The external senses are always five in number, and reside in two eyes, two ears, two nostrils, the teguments of the tongue, and those of the body generally. Certain species, however, have the eyes obliterated.

The nerves reach the medulla through perforations of the vertebræ, or of the cranium: they all seem to unite with this medulla, which, after crossing its filaments, expands to form the various lobes of which the brain is composed, and terminates in the two medullary arches (*voûtes*) termed hemispheres, the volume of which corresponds to the amount of intelligence.

There are always two jaws, the principal motion of which is in the lower one, which rises and falls; the upper is oftentimes entirely fixed: both of them are almost always armed with teeth, excrescences of a peculiar nature, the chemical composition of which is very similar to that of bone, but which grows by layers and transudations; one entire class, however, (that of birds,) has the jaws invested with horn\*, and the group of tortoises, in the class of reptiles, is in the same predicament.

The intestinal canal is continued from the mouth to the anus, undergoing various inflexions, and several enlargements and contractions; having also appendages, and receiving solvent fluids, one of which, the saliva, is discharged into the mouth: the others, which flow into the intestine only, have various names; the two principal are the juices of the gland called the pancreas [or *sweet-bread*], and the bile [or *gall*], which is the product of another very large gland, named the liver.

While the digested aliment is traversing its canal, that portion of it which is proper for nutrition, and is termed the chyle, is absorbed by particular vessels, named lacteals, and carried into the veins; the residue of the nutriment of the parts is also carried into the veins by vessels analogous to the lacteals, and forming with them one same system, designated the *lymphatic system*.†

The veins return to the heart the blood which has served to nourish the parts, together with the chyle and lymph with which it has been renewed; but this blood is obliged to pass, either wholly or in part, into the organ of respiration, to regain its arterial nature, previous to being again dispersed over the system by the arteries. In the three first classes, this organ of respiration consists of lungs, that is, an assemblage of cells into which air penetrates. In fishes only, and in some reptiles while young, it consists of gills, or a series of laminæ between which water passes.

In all the vertebrate animals, the blood which furnishes the liver with the materials of the bile is venous blood, which has circulated partly in the parietes of the intestines, and partly in a peculiar body named the *spleen*, and which, after being united in a trunk called the *vena porta*, is again subdivided at the liver.

\* M. Geoffroy St. Hilaire has described a structure in the bill of birds which presents some approach to a dentary system. In a fetus of a Parroquet nearly ready for hatching, he found that the margins of the bill were beset with tubercles arranged in a regular order, and having all the exterior appearance of teeth; these tubercles were not, indeed, implanted in the jaw-bones, but formed part of the exterior sheath of the bill. Under each tubercle, however, there was a gelatinous pulp, analogous to the pulp which secretes teeth, but resting on the edge of the maxillary bones, and every pulp was supplied by vessels and nerves traversing a canal in the substance of the bone. These tubercles form the first margins of the mandibles, and their remains are indicated by

canals in the horny sheath, subsequently formed, which contain a softer material, and which commence from small foramina in the margin of the bone. In certain other birds (as the *Mergamers*) also, the lateral edges of the bill are provided with horny processes or laminae secreted by distinct pulps, and analogous in this respect to the whale-bone laminae of the Whales, which are toothless *Mammalia*, as are also the ant-eaters and *Monotremata*: it is further remarkable that the rudiments of dentition occur in the *snouts* of the toothless Whales.

—Ed.

† The lymphatic vessels are also the media of cutaneous transudation.—Ed.

All these animals have a particular secretion, which is that of *urine*, and which is elaborated in two large glands attached to the sides of the spine of the back, and called *kidneys*: the liquid which these glands secrete, accumulates most commonly in a reservoir named the *bladder*.

The *sexes* are separate, and the female has always one or two ovaries, from which the eggs are detached at the instant of conception. The male fecundates them with the seminal fluid; but the mode varies greatly. In most of the genera of the three first classes, it requires an intromission of the fluid; in some reptiles, and in most of the fishes, it takes place after the exit of the eggs.

#### SUBDIVISION OF THE VERTEBRATE ANIMALS INTO FOUR CLASSES.

We have seen to what extent vertebrate animals resemble each other: they present, however, four great subdivisions or classes, characterized by the kind or power of their movements, which depend themselves on the quantity of respiration, inasmuch as it is from this respiration that the muscular fibres derive the energy of their irritability.

The quantity of respiration depends upon two agents: the first is the relative quantity of blood which presents itself in the respiratory organ in a given instant of time; the second, the relative amount of [free] oxygen which enters into the composition of [or is dispersed through] the ambient fluid. The quantity of the former depends upon the disposition of the organs of respiration and of circulation.

The organs of the circulation may be double, so that all the blood which is brought back from the various parts of the body by the veins, is forced to circulate through the respiratory organ before returning by the arteries; or they may be simple, so that a portion only of the blood is obliged to pass through the respiratory organ, the remainder returning to the body without having been subjected to respiration.

The latter is the case with reptiles. The amount of their respiration, and all the qualities which depend on it, vary according to the quantity of blood which is thrown into the lungs at each pulsation.

Fishes have a double circulation, but their organ of respiration is formed to execute its function through the medium of water; and their blood is only acted upon by that small portion of oxygen which is dissolved or mingled in water; so that the quantity of their respiration is, perhaps, less than that of reptiles.

In mammalians, the circulation is double, and the aerial respiration simple, that is, it is performed in the lungs only: their quantity of respiration is, therefore, superior to that of reptiles, on account of the form of their respiratory organ, and to that of fishes, from the nature of their surrounding medium.

But the quantity of respiration in birds is even superior to that of quadrupeds, since they have not only a double circulation and an aerial respiration, but also respire by many other cavities besides the lungs, the air penetrating throughout their bodies, and bathing the branches of the aorta, or main artery of the body, as well as those of the pulmonary artery.\*

Hence result the four kinds of progression to which the four classes of the vertebrate animals are more particularly destined. The quadrupeds, in which the quantity of

\* In Batrachian reptiles (frogs, newts, &c.), respiration is to a certain extent performed over the whole outer skin; which, on this account, requires to be always moist. Hence, as there can be no muscular action without previous respiration, the chemical change effected by which is needed to develop the requisite amount of vital energy, those animals of this group which in the adult state have lungs and not gills, but which pass the winter in a torpid state under water, are enabled to remain in water, and to remain in water in spring.—Ed.



respiration is moderate, are generally formed to walk and run with precision and vigour; the birds, in which it is greater, have the muscular energy and lightness necessary for flight; the reptiles, where it is diminished, are condemned to creep, and many of them pass a portion of their life in a state of torpor; the fishes, in fine, to execute their movements, require to be supported in a fluid specifically almost as heavy as themselves.\*

All the circumstances of organization proper to each of these four classes, and especially those which refer to motion and the external senses, have a necessary relation with these essential characters.

The class of mammalians, however, has peculiar characters in its viviparous mode of generation, in the manner in which the fœtus is nourished in the womb by means of the placenta, and in the mammæ by which they suckle their young.

The other classes are, on the contrary, oviparous; and if we place them together, in opposition to the first, there will be perceived numerous resemblances which announce, on their part, a special plan of organization, subordinate to the great general plan of all the vertebrates.

## THE FIRST CLASS OF VERTEBRATE ANIMALS.

### MAMMALIA.

Mammalians require to be placed at the head of the animal kingdom, not only because this is the class to which we ourselves belong, but also because it is that which enjoys the most numerous faculties, the most delicate sensations, the most varied powers of motion, and in which all the different qualities seem together combined to produce a more perfect degree of intelligence,—the one most fertile in resources, most susceptible of perfection, and least the slave of instinct.

As their quantity of respiration is moderate, they are in general designed for walking on the ground, but with vigorous and continued steps. Consequently, all the articulations of their skeleton have very precise forms, which rigorously determine their motions.

Some of them, however, by means of lengthened limbs and extended membranes, raise themselves in the air; others have the limbs so shortened, that they can employ them with effect only in water; but they do not the more on this account lose the general characters of the class.

\* To descend to particular cases, however, it would appear that species may be framed on almost every type, even very subordinate types, for any particular mode of life. Thus, to illustrate briefly, the bats, which are true mammalians, are modified for aerial progression like birds; and the whales, other mammalians, have a fish-like exterior, being designed to live exclusively in water: so there are birds which are utterly incapable of flight; some, as the ostrich, adapted to scour the plains, like a quadruped; others, as the penguin, whose only sphere of activity is in the water: the pterodactyle affords an example of a genus of flying reptiles, the fossil remains of which only have been discovered. Descending to lower groups, we find among birds, a genus of thrushes (*Otocoris*), which seeks its subsistence under water; and another of toad-palmate water-fowl (*Troglodytes*), which neither swims nor dives. Such deviations, however, from the general character of their allied genera, have no intrinsic relation to the

groups which they approximate in habit,—ought that can be regarded as an intentional or designed representation of them, as has sometimes been imagined; for it is evident, that if species based on two different plans of organization are respectively modified to perform the same office in the economy of nature, they must necessarily resemble, to a certain extent, superficially, as a consequence of that adaptation; while there are many cases also in each class which cannot well be represented in some others, as that of the mole among quadrupeds, which has no counterpart or correspondent group in the class of birds. Habit, or mode of life, has indeed nothing whatever to do with the physiological relations of organisms, which afford the only legitimate basis of classification; and those special modifications to particular habits, which, occurring alike in any class, superinduce a resemblance in superficial characters only, constitute what has been well distinguished by the term *analogy*, as opposed to *affinity*.—Ed.

They have all the upper jaw fixed to the skull, and the lower composed of two pieces only, articulated by a projecting condyle to a fixed temporal bone; the neck consists of seven vertebræ, one single species excepted, which has nine\*; the anterior ribs are attached in front, by cartilage, to a sternum formed of a certain number of pieces placed in a row; their fore-limb commences in a blade-bone, which is not articulated, but merely suspended in the flesh, often resting on the sternum by means of an intermediate bone, called a clavicle. This extremity is continued by an arm, a fore-arm, and a hand, the last composed of two ranges of small bones, called a wrist or carpus, of another range of bones termed metacarpus, and of digits or fingers, each of which consists of two or three bones, named phalanges.



Fig. 2.

Excepting the *Cetacea*, they have all the first part of the hinder extremity fixed to the spine, and forming a girdle or pelvis, which, in youth, consists of three pairs of bones,—the ilium, which is attached to the spine, the pubis, which forms the fore part of the girdle, and the ischium, which constitutes the hind part. At the point of union of these three bones is situate the cavity with which the thigh is articulated, to which, in its turn, is attached the leg, formed of two bones, the tibia and fibula: this extremity is terminated by the foot, which is composed of parts analogous to those of the hand, namely, a tarsus, metatarsus, and digits or toes.

The head of mammals is always articulated by two condyles upon the atlas, or first vertebra.

Their brain is composed of two hemispheres, united by a medullary layer termed the *corpus callosum*, containing two ventricles, and enveloping the four pairs of tubercles named the *corpora striata*, the *thalami nervorum opticorum*, or beds of the optic nerves, and the *nates* and *testes*. Between the optic beds is a third ventricle, which communicates with a fourth situated under the *cerebellum*, the crura of which always form a transverse prominence under the *medulla oblongata*, called the *pons Varolii*.

Their eye, invariably lodged in its orbit, is protected by two lids and a vestige of a third, and has its crystalline fixed by the ciliary process and its simply cellular sclerotic [or white].

In their ear, there is always found a cavity named the drum, or *tympanum*, which communicates with the back part of the mouth, by a canal termed the trumpet, or Eustachian tube: the cavity itself is closed externally by a membrane called the *membrana tympani*, and contains a chain of four little bones, named the hammer, anvil, orbicular, and stirrup bones; a vestibule, on the entrance of which rests the stirrup-bone, and which communicates with three semicircular canals; and, finally, a *cochlea*, which terminates by one passage in the drum, and by another in the vestibule.

Their cranium subdivides into three portions: the anterior is formed by the two frontal and the ethmoidal bones; the middle, by the parietal bones and the sphenoidal;

\* The sloth is alluded to, in which, however, distinct rudiments of ribs are attached to the eighth and ninth, as shown in the above figure (a, b); so that, in reality, this constitutes no exception to the universal rule.—Ed.

and the posterior, by the occipital. Between the occipital, the parietal, and the sphenoidal, are interposed the temporal bones, part of which belong properly to the face.

In the fœtus, the occipital bone divides into four parts; the sphenoidal into halves, which subdivide into three pairs of lateral wings; the temporal into three, of which one serves to complete the cranium, another to close the labyrinth of the ear, and the third to form the parietes of its drum, &c. These bony portions [centres of ossification], which are still more numerous in the earliest period of fœtal existence, are united more or less promptly, according to the species, and the bones themselves become finally consolidated in the adult.\*

Their face is essentially formed by the two maxillary bones, between which pass the nostrils, and which have the two intermaxillaries in front, and the two palate bones behind; between them descends a single lamina of the ethmoidal bone, named the *vomer*; at the entrance of the nasal canal are the bones proper to the nose; to its external parietes adhere the inferior turbinated bones, which occupy its upper and posterior portion, belonging to the ethmoidal. The jugal or cheek bone unites on each side the maxillary to the temporal bone, and often to the frontal; lastly, the lachrymal bone occupies the inner angle of the orbit, and sometimes a part of the cheek. These bones also present more numerous subdivisions in the embryo.

Their tongue is always fleshy, and attached to a bone termed the hyoid, which is composed of several pieces, and suspended from the cranium by ligaments.

Their lungs, two in number, divided into lobes, and composed of an infinitude of cells, are always inclosed without adhesion in a cavity formed by the ribs and diaphragm, and lined by the pleura; their organ of voice is always at the upper end of the windpipe; a fleshy elongation, called the *velum palati*, establishes a direct communication between their larynx and nostrils.

Their residence on the surface of the earth exposing them less to the alternations of heat and cold, their body has only a moderate kind of tegument, the hair or fur, and even this is commonly scanty in those of hot climates.†

The cetaceans, which live entirely in water, are the only ones that are altogether deprived of it.

The abdominal cavity is lined with a membrane called the peritonæum; and their intestinal canal is suspended to a fold of it, termed the mesentery, which contains numerous conglomerate glands, in which the lacteal vessels ramify: another production of the peritonæum, named the epiploon, hangs in front of and under the intestines.

The urine, retained for some time in the bladder, is discharged, in the two sexes, with very few exceptions, by orifices in the organs of generation.

In all mammalians, generation is essentially viviparous; that is to say, the fœtus, immediately after conception, descends [gradually] into the matrix, inclosed in its envelopes, the exterior of which is named *chorion*, and the interior *amnios*; it fixes itself to the parietes of this cavity by one or more plexus of vessels, termed the placenta, which establishes a communication between it and the mother, by which it receives its nourishment, and probably also its oxygenation; notwithstanding which,

\* Here it may be remarked that, descending in the series of vertebrates, the same is observable as in ascending to fœtal life in the higher groups; the progress of development, in this and other respects, being arrested at different stages of advancement, according to the class, order, and species: the brain for instance, in man, suc-

cessively assuming the conditions of this organ in fishes, reptiles, birds, the lower and then higher groups of mammalians.—Ea.

† In some monkeys from Sierra Leone, the most torrid region in the world, the hair is much elongated, but thin and coarse, as if designed to protect them from the solar rays.—Ea.

the fœtus of mammalians, at an early period, has a vessel analogous to that which contains the yolk in the oviparous classes, receiving, in like manner, vessels from the mesentery. It has also another external bladder named the allantoid, which communicates with the urinary one by a canal termed the *urachus*.

Conception always requires an effectual coitus, in which the fecundating fluid of the male is thrown into the uterus of the female.

The young are nourished for some time after birth by a fluid peculiar to this class (the milk), which is produced by the mammæ, at the time of parturition, and for as long a period as the young require it. It is from the mammæ that this class derives its name, and, being a character peculiar to it, they distinguish it better than any other that is external.\*

#### DIVISION OF THE CLASS OF MAMMALIA INTO ORDERS.

The variable characters which establish essential differences among the mammalia are taken from the organs of touch, on which depends their degree of ability or address, and from the organs of manducation, which determine the nature of their food, and are connected together, not only with all that relates to the digestive function, but also with a multitude of other differences extending even to their intelligence.

The degree of perfection of the organs of touch is estimated by the number and the mobility of the fingers, and from the greater or less extent to which their extremities are enveloped by the nail or the hoof.

A hoof which envelopes all that portion of the toe which touches the ground, blunts its sensibility, and renders the foot incapable of seizing.

The opposite extreme is where a nail, formed of a single lamina, covers only one of the faces of the extremity of the finger, and leaves the other possessed of all its delicacy.

The nature of the food is known by the grinders, to the form of which the articulation of the jaws universally corresponds.

For cutting flesh, grinders are required as trenchant as a saw, and jaws fitted like scissors, which have no other motion than a vertical one.

For bruising grain or roots, flat-crowned grinders are necessary, and jaws that have a lateral motion: in order that the crowns of these teeth should always be irregular, as in a mill, it is further requisite that their substance should be formed of parts of unequal hardness, so that some may wear away faster than others.

Hoofed animals are all necessarily herbivorous, and have flat-crowned grinders, inasmuch as their feet preclude the possibility of their seizing a living prey.

Animals with unguiculated fingers are susceptible of more variety; their food is of all kinds: and, independently of the form of their grinders, they differ greatly from each other in the mobility and delicacy of their fingers. There is one character with respect to this, which has immense influence on their dexterity, and greatly multiplies its powers; it is the faculty of opposing the thumb to the other fingers for the purpose of seizing small objects, constituting what is properly termed a *hand*; a faculty which

\* We shall find, however, in the sequel some doubts on this subject, as regards the family of *Monotremata*. [These doubts have since been removed, inasmuch as the lacteal glands have been detected, with their secretion; though, as in the cetaceans, there appear

to be no nipples, simple pressure alone causing the fluid to exude. In the class of birds, a lacteal fluid is secreted by the crops of the parrots and pigeons, which is disgorged into the throats of the young when newly hatched.—Eds.]

is carried to its highest perfection in Man, in whom the whole anterior extremity is free, and capable of prehension.

These various combinations, which rigidly determine the nature of the different mammalians, have given rise to the following orders :—

Among the unguiculates the first is MAN, who, besides being privileged in all other respects, has hands to the anterior extremities only ; his hinder limbs support him in an erect position.

In the order next to Man,—that of the QUADRUMANA, there are hands to the four extremities.

Another order, that of the CARNARIA, has not the thumb free and opposable to the other fingers.

These three orders have each the three sorts of teeth, namely, grinders, canines, and incisors.

A fourth, that of the RODENTIA, in which the toes differ little from those of the *Carnaria*, is without the canines, and the incisors are placed in front of the mouth, and adapted to a very peculiar sort of manducation.

Then come those animals whose toes are much cramped, and deeply sunk in large nails, which are generally curved ; and which have further the imperfection of wanting the incisors. Some of them are also without canines, and there are others which have no teeth at all. We comprehend them all under the name EDENTATA.

This distribution of the unguiculated animals would be perfect, and form a very regular series, were it not that New Holland has lately furnished us with a small collateral series, composed of the *pouched animals* [MARSUPIATA], the different genera of which are connected together by the aggregate of their organization, although in their teeth, and in the nature of their regimen, some correspond to the *Carnaria*, others to the *Rodentia*, and others, again, to the *Edentata*.

The hoofed animals are less numerous, and have likewise fewer irregularities.

The RUMINANTIA compose an order very distinct, which is characterized by its cloven feet, by the absence of the incisors to the upper jaw, and by having four stomachs.

All the other hoofed animals may be left together in a single order, which I shall call PACHYDERMATA or JUMENTA, the *Elephant* excepted, which might constitute a separate one, having some distant relation to that of *Rodentia*.

Lastly, those mammalians remain which have no posterior extremities, and whose fish-like form and aquatic mode of life would induce us to form them into a particular class, if it were not that all the rest of their economy is precisely the same as in that wherein we leave them. These are the warm-blooded fishes of the ancients, or the CETACEA, which, uniting to the vigour of the other mammalians the advantage of being sustained in the watery element, include among them the most gigantic of all animals.

[Linnæus reduced all mammalians to three great groups, UNGUICULATA, UNGULATA, and MUTICA ; terms which are at least convenient for their expressiveness, although the groups they represent intergrade, and in some instances invade each other, if too rigorously accepted.

His order PRIMATES, as extended to the *Bimana*, *Quadrumana*, and *Cheiroptera* of Cuvier, receives the approbation of most naturalists ; few regard the last as subordinate to the *Carnaria*, which is equivalent to *Primates*.

Viewing Man zoologically, opinion is divided respecting the propriety of assigning

him a separate ordinal station ; his rudimental structure according so nearly with that of the *Quadrumana*, of which type he presents the modification for ground habits and an upright attitude ; his more highly developed brain is merely a difference in degree.

Conceding this much, he would require to be admitted into the same particular group as all other mammalians based on the same *next* general plan of structure to that of the entire class ; which special type is externally distinguished by peculiarities in the sexual organs, a system of organs of all others the least subject to be influenced by the general modification in reference to habit.

It is thus that, after being necessarily included among the *Mammalia*, Man must next range with the other handed animals and the Bats, in a particular subdivision, which Linnæus has named *PRIMATES*.

There would appear to be four distinct major groups of *Primates* :—the *Catarrhini*, composed of the Apes, Monkeys, and Baboons of the eastern hemisphere ; the *Platyrrhini*, consisting of the anthropoid animals of America ; the *Strepsirrhini*, or Lemurs (including *Galeopithecus*, and, perhaps, *Cheiromys*) ; and the *Cheiroptera*, or Bats, which last, varying most essentially in their dentition, according as they are frugivorous, sanguivorous, or insectivorous, afford a decisive proof that the dentary system alone, like any other single character considered apart from the rest, fails to supply an invariable indication of the affinities of an animal (as has sometimes been stated). We perceive no sufficient reason why the genus *Homo* should not range at the head of the *Catarrhini*, though as a distinct family—*Hominidæ*, as opposed to *Simiadæ* ; in accordance wherewith, the *Primates* present a tolerable series, from the summit of the animal kingdom to forms that are rather low in the class of mammalians.

An analogous gradation is exhibited by the second grand division, which De Blainville has designated *Secundates* ; it is the *Carnaria* of Cuvier divested of the Bats. We prefer the latter appellation, as more in unison with the names of the succeeding orders ; and for the same reason would substitute *Primaria* for *Primates*.

Our illustrious author, with a view to present some approximation to a linear succession, has arranged the present series inversely, commencing with those least elevated in the scale, or the *Insectivora*. To this we cannot accede, as virtually implying an exploded principle. Considered as a *carnivorous* group, the Feline animals must be selected as the *standard*—most characteristic example\*—of the order ; but in its totality, without reference to especial modifications, the Dog has better claim to be placed at the *head*. Some curious analogies accordingly present themselves between the respectively highest animals of the two first orders.

As a general, perhaps universal rule obtaining in consecutive groups when sufficiently extensive, the summit of the inferior displays a higher organization than the terminal members of the superior† ; and this sometimes in a very remarkable degree, as shown in the present instance. A sort of parallelism may also frequently be observed between such members of two different ordinal types as are of a corresponding degree of elevation in the scale of being : thus, the Shrews present certain characters of the *Rodentia*, without linking with them. It is on this principle, we suspect, that transitions appear to occur in some instances, from one great type of structure to another ; and a key is hereby supplied to the proper understanding of much that seems otherwise inexplicable.

\* The word *type* is often employed in this sense : we use it in a somewhat different one.

† A proposition which is sanctioned by the acquiescence of Cuvier, as shown by his remarks on linear arrangement. Vide preface, p. 7.

We have seen, in the *Prima*, that particular plan of conformation so modified as to enable the *Prima* to fly. In the *Carnaria*, the Seals afford an example of exclusive adaptation to aquatic habits.

It could only have been the desire to maintain a sort of continuous succession, as in the former instance, which induced our author to range the *Marsupia* next to the *Carnaria*; for they are unquestionably the lowest-organized of mammalians, whence their intrusion so high in the system of the class furnishes another proof of the impropriety of allowing undue importance to particular characters. An order which has a better claim to succeed the *Carnaria*, is that of the fish-like mammalians, or *Cetacea*; but, divested of the herbivorous genera ranged in it by Cuvier, which are strict *Pachydermata*. (It is scarcely necessary to repeat, that modifications which have reference to habit do not necessarily affect the essential relations of organisms).

The *Pachydermata* follow, which, in their turn, must not be regarded as more nearly related to the last, because certain genera of them are analogously adapted for aquatic habits only. We feel compelled to reiterate this general principle, in order to preclude misconception; the sound inference seems to be, that a tendency to general modification for aquatic habits prevails in this part of the system; which certainly helps to indicate what orders should be placed in contiguity, though still not of necessity, even admitting that many analogous cases may be cited in corroboration of a vague index being thus afforded.\*

We prefer to arrange the *Ruminantia* next to the *Pachydermata*; then the *Edentata*, and the *Rodentia*; and last of all the *Marsupia*, including the *Monotremata* of Cuvier, the formerly doubtful points concerning which are now, with slight reservation, finally set at rest.

It will be perceived that this arrangement is tolerably in accordance with the ordinary cerebral developement, and consequent amount of intelligence, of the eight successive orders. Passing on to the Birds, we commence with a higher intellect (in the Parrots) than is manifested in either of the last three, or, perhaps, four orders; which agrees with the general proposition stated at p. 43.]

## THE FIRST ORDER OF MAMMALIANS.

### BIMANA, OR. MAN.

Man forms but one genus, and that genus the only one of its order. As his history is more directly interesting to ourselves, and forms the standard of comparison to which we refer that of other animals, we will treat of it more in detail.

We will rapidly sketch whatever Man offers, that is peculiar in each of his organic systems, amidst all that he has in common with other mammalians; we will describe his principal races and their distinctive characters; and finally point out the natural order of the developement of his faculties, both individual and social.

\* For an instance in point, see our remarks on certain conformities of structure observable in the two groups of Parrots and Hawks.

## REGULAR CONFORMATION OF MAN.

The foot of Man is very different from that of Apes: it is large; the leg bears vertically upon it; the heel is expanded beneath; his toes are short, and but slightly flexible; the great toe, longer and larger than the rest, is placed on the same line with and cannot be opposed to them. This foot, then, is proper for supporting the body, but cannot be used for seizing or climbing\*, and as the hands are unfitted for walking, Man is the only animal truly *bimanous* and *biped*.

The whole body of Man is modified for the vertical position. His feet, as we have already seen, furnish him with a larger base than those of other mammalians; the muscles which retain the foot and thigh in the state of extension are more vigorous, whence results the swelling of the calf and buttock; the flexors of the leg are attached higher up, which permits of complete extension of the knee, and renders the calf more apparent. The pelvis is larger, which separates the thighs and feet, and gives to the trunk that pyramidal form favourable to equilibrium: the necks of the thigh-bones form an angle with the body of the bone, which increases still more the separation of the feet, and augments the basis of the body. Finally, the head, in this vertical position, is in equilibrium with the trunk, because its articulation is exactly under the middle of its mass.

Were he to desire it, Man could not, with convenience, walk on all fours: his short and nearly inflexible foot, and his long thigh, would bring the knee to the ground; his widely separated shoulders and his arms, too far extended from the median line, would ill support the fore-part of his body; the great indented muscle which, in quadrupeds, suspends the trunk between the blade-bones as a girth, is smaller in Man than in any one among them; the head is heavier, on account of the magnitude of the brain, and the smallness of the sinuses or cavities of the bones; and yet the means of supporting it are weaker, for he has neither cervical ligament, nor are the vertebrae so modified as to prevent their flexure forward; he could therefore only maintain his head in the same line with the spine, and then, his eyes and mouth being directed towards the ground, he could not see before him; the position of these organs is, on the contrary, quite perfect, supposing that he walks erectly.

The arteries which supply his brain, not being subdivided as in many quadrupeds, and the blood requisite for so voluminous an organ being carried to it with too much violence, frequent apoplexies would be the consequence of a horizontal position.

Man, then, is designed to be supported by the feet only. He thus preserves the entire use of his hands for the arts, while his organs of sense are most favorably situated for observation.

These hands, which derive such advantages from their liberty, receive as many more from their structure. Their thumb, longer in proportion than in the apes, increases the facility of seizing small objects; all the fingers, except the annularis [and this to a certain extent], have separate movements, which is not the case in any other animal, not even in the apes. The nails, covering only one side of the extremities of the fingers, form a support to the touch, without in the least depriving it of its delicacy. The arms which support these hands have a solid attachment by their large blade-bone, their strong collar bone, &c.

Man, so highly favoured as to dexterity, is not so with regard to strength. His swiftness in running is much inferior to that of other animals of his size; having neither projecting jaws, nor salient canine teeth, nor crooked nails, he is destitute of offensive armature; and the sides and upper part of his body being naked, unprovided even with hair, he is absolutely

\* It is certain, however, that by much practice from early youth, the foot has been known to acquire an amount of dexterity in manual operations, which it would not have been supposed capable of by those whose feet have been enveloped from the time they first walked in close investments. Individuals, in particular, who have been born

with the anterior extremities imperfect, have illustrated this practicability the most remarkably. The influence of habit in training even the hand to perform its functions, will be appreciated by those who cannot use their left hand with the same freedom as the right.—E.



without defensive weapons : lastly, he is of all animals that which is latest to acquire the power necessary to provide for himself.

But this weakness even has been for him another advantage, in obliging him to have recourse to those internal means—to that intelligence which has been awarded to him in so high a degree.

No quadruped approaches him in the magnitude and convolutions of the hemispheres of the brain, that is to say, of that part of this organ which is the principal instrument of the intellectual operations ; the posterior portion of the same organ extends backwards, so as to form a second covering to the cerebellum ; even the form of the cranium announces this great size of the brain, as the smallness of the face shows how slightly that portion of the nervous system which influences the external senses predominates in him.

These external senses, however, moderate as they all are in Man, are yet extremely delicate and well balanced.

His two eyes are directed forwards ; he does not see on two sides at once, like many quadrupeds, which produces more unity in the result of his vision, and concentrates his attention more closely on objects of this kind. The ball and iris of his eye vary but little, which restrains the activity of his sight to limited distances, and to a determined degree of light. The conch of his ear, possessing but little mobility or extent, does not increase the intensity of sounds, notwithstanding which, of all animals, he best distinguishes their intonation. His nostrils, more complicated than those of apes, are less so than those of all other genera ; and yet he appears to be the only animal whose sense of smell is sufficiently delicate to be affected by unpleasant odours. Delicacy of smell must influence that of taste ; and Man must have a further advantage, in this respect, at least over those animals whose tongues are covered with scales. Lastly, the nicety of his touch results, both from the delicacy of his teguments and the absence of all insensible parts, as well as from the form of his hand, which is better adapted than that of any other animal for suiting itself to all the small inequalities of surfaces.

Man has a particular pre-eminence in his organ of voice : of all mammalians, he can alone articulate sounds ; the form of his mouth and the great mobility of his lips being probably the cause of this. Hence results his most invaluable mode of communication ; for of all the signs which can be conveniently employed for the transmission of ideas, variations of sound are those which can be perceived at the greatest distance, and in the most various directions simultaneously.

It seems that even the position of the heart and of the great vessels bears reference to the vertical carriage. The heart is placed obliquely on the diaphragm, and its point inclines to the left, thereby occasioning a distribution of the aorta differing from that of most quadrupeds.

The natural food of Man, judging from his structure, appears to consist principally of the fruits, roots, and other succulent parts of vegetables. His hands afford every facility for gathering them ; his short and but moderately strong jaws on the one hand, and his canines being equal only in length to the other teeth, together with his tuberculated molars on the other, would scarcely permit him either to masticate herbage, or to devour flesh, were these condiments not previously prepared by cooking. Once, however, possessed of fire, and those arts by which he is aided in seizing animals or killing them at a distance, every living being was rendered subservient to his nourishment, thereby giving him the means of an indefinite multiplication of his species.

His organs of digestion are in conformity with those of manducation ; his stomach is simple, his intestinal canal of mean length, his great intestines well marked, his cæcum short and thick, and augmented by a small appendage, and his liver divided only into two lobes and one small one ; his epiploon hangs in front of the intestines, and extends into the pelvis.

To complete this abridged statement of the anatomical structure of Man, necessary for this

Introduction, we will add, that he has thirty-two vertebræ, of which seven belong to the neck, twelve to the back, five to the loins, five to the sacrum, and three to the coccyx. Of his ribs, seven pairs are united to the sternum by elongated cartilages, and are called true ribs; the five following pairs are denominated false ones. His adult cranium consists of eight bones; an occipital (*occipito-basilaire*); two temporal; two parietal; a frontal; an ethmoidal, and a sphenoidal. The bones of his face are fourteen in number; namely, two maxillaries; two jugals, each of which joins the temporal to the maxillary bone of its own side by a sort of handle named the zygomatic arch; two nasal bones; two palatines, behind the palate; a vomer, between the nostrils; two turbinated bones of the nose in the nostrils; two lachrymals in the inner angles of the orbits, and the single bone of the lower jaw. Each jaw has sixteen teeth: four cutting incisors in the middle, two pointed canines at the corners, and ten molars with tuberculated crowns, five on each side, in all thirty-two teeth. His blade-bone has at the extremity of its spine or projecting ridge a tuberosity, named the acromion, to which the clavicle or collar-bone is connected, and over its articulation is a point termed the coracoid process, to which certain muscles are attached. The radius turns completely on the cubitus or ulna, owing to the mode of its articulation with the humerus. The wrist has eight bones, four in each range; the tarsus has seven; those of the remaining parts of the hand and foot may be easily counted by the number of digits.

Enjoying, by means of his industry, uniform supplies of nourishment, Man is at all times inclined to sexual intercourse, without being ever furiously incited. His generative organ is not supported by a bony axis; the prepuce does not retain it attached to the abdomen; but it hangs in front of the pubis: numerous and large veins, which effect a rapid transfer of the blood of his testes to the general circulation, appear to contribute to the moderation of his desires.

The uterus of woman is a simple oval cavity; her mammae, only two in number, are situated on the breast, and correspond with the facility she possesses of supporting her child upon her arm.

#### PHYSICAL AND MORAL DEVELOPEMENT OF MAN.

The ordinary produce of the human species is but one child at a birth; for in five hundred cases of parturition, there is only one of twins, and more than that number is extremely rare. The period of gestation is nine months. A fetus of one month is ordinarily an inch in height; at two months, it is two inches and a quarter; at three months, five inches; at five months, six or seven inches; at seven months, eleven inches; and at nine months, eighteen inches. Those which are born prior to the seventh month usually die. The first or milk teeth begin to appear a few months after birth, commencing with the incisors. The number increases in two years to twenty, which are shed successively from about the seventh year, to be replaced by others. Of the twelve posterior molars, which are permanent, there are four which make their appearance at four years and a half, four at nine years; the last four being frequently not cut until the twentieth year.

The fetus grows more rapidly in proportion as it approaches the time of birth. The infant, on the contrary, increases always more and more slowly. It has upwards of a fourth of its height when born, attains the half of it at two years and a half, and the three fourths at nine or ten years. By the eighteenth year the growth almost entirely ceases. Man rarely exceeds six feet, and seldom remains under five. Woman is ordinarily some inches shorter.

Puberty manifests itself by external signs, from the tenth to the twelfth year in girls, and from the twelfth to the sixteenth in boys. It arrives sooner in warm climates. Either sex very rarely produces before the epoch of this manifestation.

Scarcely has the body attained its full growth in height, before it commences to increase in bulk; fat accumulates in the cellular tissue. The different vessels become

gradually obstructed; the solids become rigid; and after a life more or less prolonged, more or less agitated, more or less painful, old age arrives, with decrepitude, decay, and death. Man rarely lives beyond a hundred years; and most of the species, either from disease, accidents, or merely old age, perish long before that term.

and a difficult mutual attachment. The nearly equal sexes, the difficulty of supporting more than one wife, when the want of power, intimate that monogamy is the natural condition and as, wherever this kind of union exists, the sire participates in the education of his offspring, the length of time required for that education allows the birth of others, whence the natural perpetuity of the conjugal state. From the long period of infantile weakness results domestic subordination, and, consequently, the order of society at large, as the young persons which compose the new families continue to preserve with their parents those tender relations to which they have so long been accustomed. This disposition to mutual assistance multiplies to an almost unlimited extent those advantages previously derived by isolated Man from his intelligence; it has assisted him to tame or repulse other animals, to defend himself from the effects of climate, and thus enabled him to cover the earth with his species.

In other respects, Man appears to possess nothing resembling instinct, no regular habit of industry produced by innate ideas; all his knowledge is the result of his sensations, his observations, or of those of his predecessors. Transmitted by speech, increased by meditation, applied to his necessities and his enjoyments, they have given rise to all the arts. Language and letters, by preserving acquired knowledge, are a source of indefinite perfection to his species. It is thus that he has acquired ideas, and made all nature contribute to his wants.\*

There are very different degrees of developement, however, in Man.

The first hordes, compelled to live by hunting and fishing, or on wild fruits, and being obliged to devote all their time to search for the means of subsistence, and not being able to multiply greatly, because that would have destroyed the game, advanced but slowly; their arts were limited to the construction of huts and canoes, to covering themselves with skins, and fabricating arrows and nets; they observed such stars only as served to direct them in their journeys, and some natural objects whose properties were of use to them; they gained the dog for a companion, because he had a natural inclination for the same kind of life. When they had succeeded in taming the herbivorous animals, they found in the possession of numerous flocks a never-failing source of subsistence, and some leisure, which they employed in extending the sphere of their acquirements. Some industry was then employed in the construction of dwellings and the making of clothes; the idea of property was admitted, and, consequently, that of barter, together with wealth and difference of conditions, those fruitful sources of the noblest emulation and the vilest passions; but the necessity of searching for fresh pastures, and of obeying the changes of the seasons, still doomed them to a wandering life, and limited their improvement to a very narrow sphere.

The multiplication of the human species, and its improvement in the arts and sciences, has

\* The numerous structural confidences, all of which are required to promote the intellectual development of mankind, are worthy of serious consideration with reference to the unaided faculties of other animals.

For example, if the superior intelligence of Man were not seconded by his admirable hands (so vastly exceeding those of the monkey tribe), by his efficient vocal organ, &c., which are obvious to all as mere physical conformations, indeed, but slight modifications of what occur in other animals, — if, in short, he were reduced in these respects to the condition of the Dog, how effectually would the privation operate to prevent that progressive advancement which, under existing circumstances, is achieved by the human race only.

But, even grant to Man the use of all his organs, yet deprive him of the accumulated experience of his predecessors, and all mental culture beyond the result of his incidental experience (which in brutes is a

necessary consequence of their imperfect means of communication), and we perceive how immensely he is indebted also to these accessories.

On the other hand, however, a duly developed brain and commensurate intelligence are required to enable Man to avail himself of the advantages of his structure, for otherwise he appears doomed to remain stationary like a brute (as in the instance of the New Hollanders), even in the midst of civilization. There are also casualties, as the general insecurity of life or property arising from situation or misgovernment, which ordinarily suffice to repel the efforts of advancement, even of the most intelligent races.

It would accordingly, then, appear, that the characteristic traits of human intellect are mainly due to the co-operation of extrinsic causes, and to the accessory aids afforded by physical conformation. —En.

only been carried to a high degree since the invention of agriculture and the division of the soil into hereditary possessions. By means of agriculture, the manual labour of a portion of society is adequate to the maintenance of the whole, and allows the remainder time for less necessary occupations, at the same time that the hope of acquiring, by industry, a comfortable subsistence for self and posterity, has given a new spring to emulation. The discovery of a representative of property, or a circulating medium, has carried this emulation to the highest degree, by facilitating exchanges, and rendering fortunes more independent and susceptible of being increased; but by a necessary consequence, it has also equally increased the vices of effeminacy and the furies of ambition.

In every stage of the development of society, the natural propensity to reduce all knowledge to general principles, and to search for the causes of each phenomenon, has produced reflecting men, who have added new ideas to those already accumulated; nearly all of whom, while knowledge was confined to the few, endeavoured to convert their intellectual superiority into the means of domination, exaggerating their merit in the eyes of others, and disguising the poverty of their knowledge by the propagation of superstitious ideas.

An evil more irremediable, is the abuse of physical power; now that Man only can injure Man, he affords the only instance of a species continually at war with itself. Savages dispute their forests, and herdsmen their pastures; and make irruptions, as often as they can, upon the cultivators of the soil, to deprive them of the fruits of their long and painful labours. Even civilized nations, far from being satisfied with their enjoyments, carry on war for the prerogative of pride, or the monopoly of commerce. Hence the necessity of governments to direct the national wars, and to repress or reduce to regular forms the quarrels of individuals.

Circumstances, more or less favourable, have restrained the social condition within limited degrees, or have promoted its development.

The glacial climates of the north of both continents, and the impenetrable forests of America, are still inhabited by the savage hunter or fisherman. The immense sandy or salt plains of Central Asia and Africa are covered with a pastoral people, and innumerable herds: these half-civilized hordes assemble at the call of every enthusiastic chief, and overrun the cultivated countries that surround them, in which they establish themselves but to become enervated, and to be subjected in their turn to the next invaders. This is the true cause of that despotism, which, in every age, has crushed the industry called forth under the fine climates of Persia, India, and China.

Mild climates, soils naturally irrigated and rich in vegetables, are the natural cradle of agriculture and civilization; and when their position is such as to afford shelter from the incursions of barbarians, talents of every kind are mutually excited; such were formerly (the first in Europe,) Italy and Greece; and such is, at present, nearly all that happy portion of the earth's surface.

There are, however, certain intrinsic causes which appear to arrest the progress of particular races, even though situated amidst the most favourable circumstances.

#### VARIETIES OF THE HUMAN SPECIES.

Although the human species would appear to be single, since the union of any of its members produces individuals capable of propagation\*, there are, nevertheless, certain hereditary peculiarities of conformation observable, which constitute what are termed *races*.

Three of these in particular appear eminently distinct: the *Caucasian*, or white, the *Mongolian*, or yellow, and the *Ethiopian*, or negro.

The Caucasian, to which we belong, is distinguished by the beauty of the oval which forms the

\* It is now certain that this circumstance affords no proof of specific identity, inasmuch as many newly allied but obviously distinct species produce hybrids that are prolific *inter se*: an instance of

which I have just witnessed, in the class of birds, of a brood of ducks, both parents of which were half mallard and half pintail (*Anas boschas* and *A. cresta*). See note to p. 19.—E.

head; and it is this one which has given rise to the most civilized nations,—to those which have generally held the rest in subjection: it varies in complexion and in the colour of the hair.

The Mongolian is known by his projecting cheek-bones, flat visage, narrow and oblique eyebrows, scanty beard, and olive complexion. Great empires have been established by this race in China and Japan, and its conquests have sometimes extended to this side of the Great Desert; but its civilization has always remained stationary.

The Negro race is confined to the southward of the Atlas chain of mountains: its colour is black, its hair crisped, the cranium compressed, and nose flattened. The projecting muzzle and thick lips evidently approximate it to the Apes: the hordes of which it is composed have always continued barbarous.

The name *Caucasian* has been affixed to the race from which we descend, because tradition and the filiation of nations seem to refer its origin to that group of mountains situate between the Caspian and Black Seas, whence it has apparently extended by radiating all around. The nations of the Caucasus, or the Circassians and Georgians, are even now considered as the handsomest on earth. The principal ramifications of this race may be distinguished by the analogies of language. The Armenian or Syrian branch, spreading southward, produced the Assyrians, the Chaldeans, the hitherto untameable Arabs, who, after Mahomet, expected to become masters of the world; the Phœnicians, the Jews, the Abyssinians, which were Arabian colonies, and most probably the Egyptians. It is from this branch, always inclined to mysticism, that have sprung the most widely extended forms of religion. Science and literature have sometimes flourished among its nations, but always in a strange disguise and figurative style.

The Indian, German, and Pelasgic branch is much more extended, and was much earlier divided: notwithstanding which, the most numerous affinities have been recognized between its four principal languages—the Sanscrit, the present sacred language of the Hindoos, and the parent of the greater number of the dialects of Hindostan; the ancient language of the Pelasgi, common parent of the Greek, Latin, many tongues that are extinct, and of all those of the south of Europe; the Gothic or Teutonic, from which are derived the languages of the north and north-west of Europe, such as the German, Dutch, English, Danish, Swedish, and their dialects; and finally, the Sclavonian, from which are descended those of the north-east, the Russian, Polish, Bohemian, and that of the Vandals.

It is by this great and venerable branch of the Caucasian stock, that philosophy, the arts and sciences, have been carried to their present state of advancement; and it has continued to be the depository of them for thirty centuries.

It was preceded in Europe by the Celts, whose tribes, once very numerous, came by the north, and are now confined to its most western extremities; and by the Cantabrians, who passed from Africa into Spain, and have become confounded with the many nations whose posterity have intermingled in that peninsula.

The ancient Persians originate from the same source as the Indians, and their descendants still present a very close resemblance to the nations of Europe.

The Scythian and Tartar branch, extending first towards the north and north-east, and always wandering over the immense plains of those countries, returned but to devastate the happier abodes of their more civilized brethren. The Scythians, who, at so remote a period, made irruptions into Upper Asia; the Parthians, who there destroyed the Greek and Roman domination; the Turks, who there subverted that of the Arabs, and subjugated in Europe the unfortunate remnant of the Grecian people, were all offshoots from this branch. The Finlanders and Hungarians are tribes of the same division, which have strayed among the Sclavonic and Teutonic nations. Their original country, to the north and eastward of the Caspian Sea, still contains inhabitants who have the same origin, and speak similar languages; but these are mingled with many other petty nations, variously descended, and of different languages. The Tartars remained unmixed longer than the others throughout that extent of country included between the mouth of the Danube to beyond the Irtisch, from which they so long menaced Russia, and where they have finally been subjugated by her. The Mongoles, however, have mingled their blood with that of the nations they conquered, many traces of which may still be found among the inhabitants of Lesser Tartary.

It is to the east of this Tartar branch of the Caucasian race that the Mongolian race begins, whence it extends to the eastern ocean. Its branches, the Calmucks and Kalkas, still wandering shepherds,

traverse the great desert. Thrice did their ancestors, under Attila, Genghis, and Tamerlane, spread far the terror of their name. The Chinese are the most anciently civilized branch, not only of this race, but of all known nations. A third branch, the Manchures, have recently conquered and still govern China. The Japanese, Koreans, and nearly all the hordes which extend to the north-east of Siberia, subject to Russia, are also to be considered, in a great measure, as originating from this race; and such also is deemed to be the fact with regard to the original inhabitants of various islands bordering on that archipelago. With the exception of some Chinese literati, the nations of the Mongolian race pertain generally to different sects of Buddhism, or the religion of Fo.

The origin of this great race appears to have been in the Altai mountains, as that of ours in the Caucasus; but it is impossible to trace with the same certainty the filiation of its different branches. The history of these wandering nations is as fugitive as their establishments; and that of the Chinese, confined exclusively to their own empire, furnishes little that is satisfactory with respect to their neighbours. The affinities of their languages are also too little known to direct us in this labyrinth.

The languages of the north of the peninsula beyond the Ganges, as well as that of Thibet, bear some relation to the Chinese, at least in their monosyllabic structure; and the people who speak them are not without resemblance to the other Mongoles: but the south of this peninsula is inhabited by Malays, whose forms approach them much nearer to the Indians, and whose race and language are distributed over the coasts of all the islands of the Indian archipelago. The innumerable small islands of the southern ocean are also peopled by a handsome race, who appear to hold a near relation to the Indians, and whose language has much affinity with the Malay: but in the interior of the larger islands, particularly in the milder portions of them, there exists another race of men with black complexions, and negro faces, all extremely barbarous, which are named Alfoursous; and on the coasts of New Guinea and the neighbouring islands, are other Negroes nearly similar to those of the eastern coast of Africa, which are termed Papous; to the latter are generally referred the natives of Van Diemen's Land [now rapidly approaching to extermination], and those of New Holland to the Alfoursous.\*

Neither the Malays nor the Papous are easily referable to either of the three great races; but can the former be clearly distinguished from their neighbours on both sides, the Caucasian Indians and the Mongolian Chinese? We avow that we cannot discern in them sufficient traits for that purpose. Are the Papous Negroes, which may formerly have strayed into the Indian Ocean? We possess neither figures nor descriptions precise enough to enable us to reply to this question.

The inhabitants of the north of both continents, the Samoyedes, the Laplanders, and the Esquimaux, are derived, according to some, from the Mongolian race: but others regard them as mere degenerate offshoots from the Scythian and Tartar branches of the Caucasian race.

The Americans have not yet been referred clearly to either of the races of the eastern continent; nevertheless, they have no precise or constant character, which can entitle them to be considered as a particular one. Their copper-coloured complexion is not sufficient: their general black hair and scanty beard would induce us to approximate them to the Mongoles, if their defined features, their nose as projecting as ours, their large and open eyes, did not oppose such a theory, and correspond with the features of the European. Their languages are as numberless as their tribes, and no demonstrative analogies have as yet been obtained, either with each other, or with those of the ancient world.†

[With all deference, I would suggest that naturalists are much too prone to confound resemblance with identity; as if any reason existed of necessity, for analogous races to differ in the least degree. How many geographical mutual representatives are there, which the analogy of allied races forcibly indicates to be distinct, though undistinguishable on minute comparison! How nearly also do many acknowledged species resemble! Bearing these facts in mind, does it not appear that the Americans have as good a claim to be regarded as a primary race, as the Mongolians have to be separated as such from the Caucasians? The arrangement of Blumenbach, who adds the Malayan and American races to the three admitted by Cuvier, has been more generally adopted: but there would seem to be quite as good reason for admitting others. Fischer, in his *Synopsis Mammalium*, indicates what he conceives to be seven species of *Homo* (reducing the number that had previously

\* Refer, for the different races which people the islands of the Indian and Pacific Oceans, to the dissertation of MM. Lesson and Gernet, in the *Zoologie du Voyage de la Coquille*, p. 1—112. For the languages of the Asiatic nations, and their affinities, consult the *Atlas Polyglotte* of M. Klaproth.

† See, on the subject of the Americans, the travels of M. de Humboldt, so rich in important information, and the dissertations of Vater and of Mitchell.

been assigned by Bory St. Vincent): and the numerous divisions and subdivisions of that naturalist being tolerably in accordance with the apparent value of the characters presented, whether or not they truly represent the real distinctions, or, in some instances, similarity be confounded with identity (a problem to which philology seems to offer the only key), the outline of his arrangement may be transferred to the present work, where it may chance to prove useful to some observers. His supposed species are as follow:—

1. *H. Japeticus*, Bory; corresponding to the Caucasian race of Cuvier.—This is distributed under three principal varieties, termed *Caucasicus*, *Arabicus*, and *Indicus*: of these the first is arranged into six subvarieties, named *Caucasicus* (*Orientalis*), *Pelagicus* (*Meridionalis*), *Celticus* (*Occidentalis*), *Germanicus* (*Borealis*), and *Sclavonicus* (*Intermedius*), which severally comprehend the Caucasian, Palaestic, Celtic, Teutonic, and Slavonic (including the Sarmatic) nations; the second into two subvarieties, *Atlanticus* (*Occidentalis*), and *Adamicus* (*Orientalis*), respectively containing the Phœnicians, ancient Numidians, and Guanches, or the Punic nations, and the Abyssinians, primitive Egyptians (modern Copts), Jews, Armenians, Arabians, &c., or the Coptic and Semitic nations.

2. *H. Neptunianus*, Bory.—Ranged under three subdivisions: the first unnamed (*Qu. Malayanus*?) allied to—probably much mingled with—the Indian variety of *H. Japeticus*, and consisting of the well-known Malays, which people the coasts only of the peninsula of Malacca, the islands of the Indian ocean, Madagascar, &c., never penetrating inland; the second, *Occidentalis*, comprising the New Zealanders, and natives of the Society, Friendly, Sandwich, and other islands scattered over the Pacific ocean,—it is suggested, also, (but with due and much required hesitation,) the ancient Mexicans and Peruvians: the third, *Papuanus*, composed of certain inhabitants of part of the north coast of New Guinea, the shores of the islands Waigou, Salwaty, Gammeu, and a few others, is obviously a hybrid race, derived from the intermixture of the Malay and true Papou. Cuvier has remarked the affinity of language subsisting between the Malays and South Sea Islanders.

3. *H. Scythicus*, Bory.—The first division of this, unnamed (*Qu. Mongolensis*?) consists of the Calmucks and other Tartars; the second, *Sinicus* (*Homo sinicus* of Bory), of the Chinese, Japanese, &c.; and the third and last, *Hyperboreus* (*Homo hyperboreus*, Bory), of the Esquimaux. It corresponds to the Mongolian race of Cuvier.

4. *H. Americanus*, Bory.—“*Species*,” the author writes, “*adhuc male cognita, forsan tota vel ex parte ad Scythicam reducenda*,” of which the latter only is in the least probable. “*Autochthones America meridionalis, in stirpes innumeras distributi; e. g. Omagua, Guarani, Coroadi, Atures, Otomaqui, Botucudi, Guicæ, Cherrucæ, &c.*” \* A second division is designated *Patagonus*, (being the *Homo Patagonus* of Bory,) composed of the large-statured Patagonians.

5. *H. Columbicus*, Bory.—The ordinary red Indian of America.

6. *H. Æthiopicus*, Bory.—Divided into the true Negro, not otherwise named; *Caffer*, (*Homo Caffer*, Bory,) inhabiting Caffraria, and part of the coast of Madagascar; *Melanoides*, (*Homo melaninus*, Bory), the Papous or indigenous inhabitants of Madagascar, the shores of New Guinea, the islands of New Britain, New Ireland, and many others, also of Van Diemen’s Land; and *Hottentotus* (*Homo Hottentotus*, Bory), the Bush and other Hottentots, which, it may be remarked, have not a few analogies with the nomadic Mongoles. The last appear to have been much reduced and encroached on, till a remnant only is left near the south coast of Africa, just as the Celts are now confined to the extreme west of Europe.

7. Lastly, *H. Polynesiæ*, Fischer (*H. australaricus*, Bory).—The Alfourous, the lowest in the scale of human beings: comprising the inland inhabitants of the Malay peninsula, the islands of the Indian Ocean, Madagascar, New Guinea, New Holland, &c.

Such is the arrangement of an able and accomplished naturalist, published in 1829, or the same year in which our author gave to the world his second and last edition of the present work. The most recent authority, which is the third edition of Dr. Prichard’s elaborate “*Researches into the Physical History of Mankind*,” contends strenuously for unity of species in the genus *Homo*: but it may be remarked that much stress is laid on the productiveness of mingled races of mankind, without any new or satisfactory evidence being adduced in proof of the comparative sterility of the hybrid offspring of the more intimately approximate races which have claim to be ranked as species; such as

\* “A species imperfectly known, probably or in part referable to the preceding one. It comprehends numerous tribes of South America, some of which are above named. For the characters of these species, want of space compels me to refer the reader to the original work. A cranium of the savage tribe of *Botucudi* is figured by Spix in his work on American Quadrumanæ.”



the wild bovine and striped equine animals, &c. &c. The following are the leading *varieties* of Man, according to the opinion and arguments of Dr. Prichard.

"On comparing the principal varieties of form and structure which distinguish the inhabitants of different countries, we find that there are seven classes of nations which may be separated from each other by strongly marked lines. Among their principal characteristics are peculiar forms of the skull, but these are by no means the only difference which require notice and particular description. These seven principal classes are, first, those nations which in the form of their skulls and other physical characters resemble Europeans, including many nations in Asia and some in Africa; secondly, races nearly similar in figure, and in the shape of the head, to the Kalmaucks, Mongoles, and Chinese. These two first classes of nations will be designated, for reasons to be explained, *Iranian* and *Turanian* nations, in preference to *Caucasian* and *Mongolian*. \* \* \* The third class are the native American nations, excluding the Esquimaux and some tribes which resemble them more than the majority of inhabitants of the New World. The fourth class comprises only the Hottentot and Bushman race. A fifth class are the Negroes; the sixth, the Papuas, or woolly-haired nations of Polynesia; the seventh, the Alfourou and Australian races. The nations comprised under these departments of mankind differ so strikingly from each other, that it would be improper to include any two of them in one section, and there is no other division of the human family that is by physical traits so strongly characterized. There are, indeed, some nations that cannot be considered as falling entirely within either of these divisions, but they may be looked upon as approximating to one or another of them." \*

The same writer affirms, of the Caucasian race of Cuvier, that "there is no truth in the assertion that the traditions of all these nations deduce their origin from Caucasus†," and states, of his Indo-Atlantic, or *Iranian* nations, that "complexion does not enter among the characters of this type, since it is of all shades, from the white and florid colour of the northern Europeans, to the jet-black of many tribes in Lybia, and southward of Mount Atlas. In many races, as we shall hereafter prove, the type has degenerated. The ancient Celts appear, for example, to have had by no means the same development of the head as the Greeks, and the Indians display some differences in the configuration of the skull," &c.‡

It appears to be conclusively proved that barbarism and insufficient nourishment tend, in a few generations, to deteriorate the physical characters of even the highest races of mankind, by increasing the facial angle, &c.§; while the reverse induces proportional improvement. Still there is reason to suspect that the diversities which are thus occasioned are restrained within moderate limits; and this remarkable fact must be borne in mind (which I believe has not been hitherto stated), that while an artificial mode of life would seem to have produced those acknowledged *varieties* of species which are noticeable among such of the lower animals as have been domesticated, we observe very dissimilar races of human beings among those whose manner of living is least artificial of any, and which, furthermore, in numerous instances, inhabit the same countries, besides being widely diffused; thus proving that climate and locality exert less influence than has been imagined. This most difficult subject of inquiry, in fine, is endlessly perplexed, and in several instances rendered quite inextricable, by the occasional blending of two or more diverse races, in every degree of proportion. There are also decisive proofs (afforded by architectural reliques scattered over Siberia and both Americas) of great nations having been utterly exterminated, whose very names have perished: and if civilized, or comparatively civilized, populous nations have thus become so completely sunk in oblivion, that we infer their former existence only as that of some lost tribes of animals can be recalled, how very many hordes of savages, who erect no memorials, may have been extirpated, and are forgotten irretrievably. Hence the extreme and apparently insuperable difficulties which, it is probable, will continue to oppose the definitive solution of the intricate and peculiarly interesting problem which we have been considering.]

\* Vol. I. 246-7.

† Id. 269.

‡ Id. 262.

§ Vide id. vol. II. 249.



## THE SECOND ORDER OF MAMMALIANS.

## QUADRUMANA.

Independently of the anatomical details which distinguish it from Man, and which we have indicated, this family differs from our species in a very obvious character, having the thumbs of the hind feet free and opposable to the other digits, which are as long and flexible as those of the hand: in consequence of this, all the species climb trees with facility, while it is only with pain and difficulty that they can stand and walk upright, their foot then resting on its outer edge only, and their narrow pelvis being unfavourable to an equilibrium. They all have intestines very similar to those of Man\*, the eyes directed forward, the mammae on the breast, the penis pendent, the brain with three lobes on each side, the posterior of which covers the cerebellum, and the temporal fosse separated from the orbit by a bony partition. In every thing else, however, they gradually recede from him, in presenting a muzzle more and more elongated, a tail and a gait more like that of quadrupeds: nevertheless, the freedom of their arms, and the complication of their hands, admit of their performing many of the actions of Man, as well as to imitate his gestures.

They have long been divided into two genera, the Monkeys and the Lemurs, which, by the multiplication of secondary forms, have now become two small families, between which must be placed a third genus, that of the Quistitis [or Marmosets], which cannot be referred to either of the others.

THE MONKEY-LIKE ANIMALS (*Simia*, Linnæus).

These are all Quadrumana, which have four straight incisors to each jaw, and flat nails to all the extremities,—two characters which approximate them more nearly to Man than the subsequent genera. Their molars have also blunt tubercles like ours, and they subsist mainly upon fruits; but their canines, being longer than the other teeth, supply them with a weapon which we do not possess, and require a vacant space in the opposite jaw to receive them when the mouth is closed.

They may be divided, according to the number of their molars, into two principal sub-genera, which again subdivide into numerous others.

The MONKEYS (*Singes*), properly so called, or those of the ancient continent,

[CATARRHINI, *Geof.*].—

Have the same number of grinders as Man, but otherwise differ among themselves in the characters which give rise to the following subdivisions.

THE OURANGS (*Simia*, *Erkl.*, *Pithecus*, *Geof.*).—

Are the only Apes of the ancient continent which have no callosities on the buttocks; their hyoid bone, liver, and cæcum resemble those of Man. Their nose does not project; they have no cheek pouches, nor any vestige of a tail.

Some of them have arms long enough to reach the ground when standing; their legs, on the contrary, are very short. Such are the Ourangs, strictly so called.

\* Here we must except the genus *Semnopithecus*, and probably also *Colobus*.—*Ed.*

THE OURANG-OUTANG\* (*Simia satyrus*, Lin.)

Of all animals, this is reputed to bear the nearest resemblance to Man in the form of its head, the magnitude of its forehead, and volume of brain; but the exaggerated descriptions of some authors respecting this similarity arise partly from the circumstance of only young individuals having been observed, as there is every reason to believe that, with age, the muzzle becomes much more prominent [a fact now ascertained]. The body is covered with coarse red hair, the face is bluish, and the hinder thumbs very short compared with the toes. The lips are capable of a singular elongation†, and possess great mobility. Its history has been much confounded with that of the other large Apes, and especially of the Chimpanzee; but, after subjecting it to a rigorous analysis, I have ascertained that it inhabits only the most eastern countries, such as Malacca, Cochin China, and particularly the great island of Borneo, whence it has been sometimes brought by the route of Java, though very rarely. When young, and such as it has been seen in Europe, it is a very mild animal, that is easily rendered tame and attached, and which, by its conformation, is enabled to imitate many of our actions; but its intelligence appears to be lower than has been asserted, not very much surpassing that of the Dog. Camper discovered, and has well described, two membranous sacs which communicate with the glottis of this animal, and obstruct its voice; but he is mistaken in supposing that the nails are always absent from the hinder thumbs.

There is an ape in Borneo, at present only known by its skeleton, called the *Pongo*, which so closely resembles the Ourang-outang in all its parts, and by the arrangement of the cavities and sutures of its head, that notwithstanding the great prominence of its muzzle, the smallness of the cranium, and the height of the forehead of the lower jaw, we are inclined to consider as an adult, if not of this species of Ourang, at least of another very nearly allied to it. The length of its arms, and of the apophyses of its cervical vertebrae, together with the tuberosity of its calcaneum, may enable it to assume the vertical position. It is the largest of known Apes, approaching to the size of Man.

[The *Pongo* has proved to be a second species of Ourang, covered with black, relieved with dark red hair, and which at present is known only to occur in Borneo, where the Red Ourang has not been ascertained to exist. Both attain the same large dimensions, and are distinguished as the *Pithecus Wornelli* and *P. abelii*. They differ somewhat in the configuration of the cranium, and considerably in the profile of the face, as seen in the skull. A third species, also from Borneo, has more recently been determined by Prof. Owen, of which only a single adult skull has been received; it announces a smaller animal, which has been named *P. morio*. The adult males of this genus have an immense projecting tuberosity on each cheek.‡

These Ourangs do not ordinarily assume the upright attitude, to maintain which they are obliged to raise, and throw their long arms backward, in order to preserve a balance; the outer edges only of their feet are applied to the ground, where they commonly progress by resting on the knuckles, and swinging the body forward between the arms. Their structure is more designed for traversing the forest boughs; and they are said to inhabit the upland forests of the interior of their native countries. The old males are reported to be savage and solitary, and much dreaded by the Alfourou inhabitants of their native region; each appropriating a particular district, into which it resents intrusion. There is reason to suspect that they are not exclusively vegetable feeders, but subsist in part on the eggs and callow young of birds. They are sedentary and inactive animals, possessed of great strength.

So excessive is the degradation of the adult from the characters which it exhibits in youth, that our author, in his first edition, arranged the *Pongo* next to the Baboons, allowing them the precedence. According to M. Geoffroy, "the brain of the young Ourang bears a very close resemblance to that of a child; and the skull, also, might be taken, at an early age, for that of the latter, were it not for the development of the bones of the face. But it happens, in consequence of its advance in age, that the brain ceases to enlarge, while its case continually increases. The latter becomes thickened, but in an unequal degree; enormous bony ridges appear, and the animal assumes a frightful aspect. When we compare the effects of age in Man and the Ourang, the difference is seen to be, that in the latter there is a super-development of the osseous, muscular, and tegumentary systems, more towards the upper part than the lower, while the development of the brain is entirely arrested." It is only in the male sex, however, that the cranial ridges appear, the canines, also, of the females being much smaller. M. Geoffroy thus describes the skull of the *Pongo*, before its identity as an Ourang had been ascertained:—"What is most remarkable," he observes, "is the excessive elongation of the muzzle; and as this considerable volume of the muzzle cannot be gained but at the expence of the other adjoining parts, we accordingly find that there is scarcely any apparent forehead, that the bony box which contains the brain is uncommonly small, and that the occipital foramen is situated as far as the posterior part of the head. The immense muzzle, moreover, is remarkable, not only for the enormous thickness of the gums, but also for the extraordinary size of the canine and incisor teeth with which they are provided; the incisors exceed in magnitude those of a Lion, and the canines do not differ much in dimensions from those of the same animal: the occiput also is elevated at its point, and forms a quadrilateral protuberance, very large and thick, where three bony crests are produced, not less apparent nor less solid than those of the Lion. Two of

\* Ourang is a Malay word, signifying rational being, which is applied to Man, the Ourang-outang, and the Elephant. *Ourang* signifies wild, or of the woods; hence *Ourang-outang*.

† Noticeable, to a certain extent, in the Hottentot race of mankind.—Eds.

‡ There is at present (1839) a young male and female of the Black

Ourang (*P. Wornelli*), in the menagerie of the Zoological Society, which have continued now for several months in a very thriving condition, and afford reasonable grounds for expectation that they will live to attain maturity. Most of those previously imported have been weak and sickly.—Eds.

these crests are considerably elevated, and extend laterally to the auricular foramina. Another extends across the vertex, and then assumes a bifurcal form, as in the Lion, above the forehead in two lateral branches, which proceed as far as the external side of the upper edge of the orbits. These little crests are decisively marked, and form an equilateral triangle with the upper edge of the orbital foramina. The head is formed like the half of a pyramid, and the auricular foramina are placed so considerably above the palatine bones, that a line let down from the former to the internal edge of the *osse palatina*, would form, with a horizontal line, an angle of twenty-five degrees.\* It varies to about thirty degrees.

All the above modifications have immediate reference to the immense size of the canines, which necessitates a proportional development of the jaws, and the high cranial ridges to furnish attachment to muscles of sufficient power to work them. The Ourangs do not cut their huge permanent teeth until nearly full grown.†]

In the other Ourangs, the arms descend only to the knees. They have no forehead, and their cranium retreats immediately from the crest of the eyebrow. The name of CHIMPANZEE might be exclusively applied to them.

*Sim. troglodytes*, Lin. [*Troglodytes niger* of others].—Covered with black or brown hair, scanty in front; [a white marking on the rump]. If the reports of travellers can be relied on, this animal must equal or be superior in size to Man. [The skeleton of an adult female in London is considerably smaller.] It inhabits Guinea and Congo, lives in troops, constructs huts of branches, arms itself with clubs and stones, and thus repulses Man and Elephants; pursues and abducts, it is said, negro women†, &c. Naturalists have generally confounded it with the Ourang-outang. In domestication it is very docile, and readily learns to walk, sit, and eat like a man. [It is much more a ground animal than the Ourangs, and runs on its lower extremities without difficulty, holding up the arms. Is of a lively and active disposition. The facial angle of the adult about thirty-five degrees. By the general consent of living naturalists, the Chimpanzee is placed next to Man in the system, preceding the Ourangs, which it exceeds in general approximation to the human form.]

From the foregoing groups are now separated

#### THE GIBBONS (*Hylobates*, Illiger),—

Which, together with the long arms of the Ourangs, and the receding forehead of the Chimpanzee, possess [all of them] callosities on the buttocks like the true Monkeys; differing, however, from the latter in having no tail or cheek-pouches. All of them inhabit the most eastern part of India, and its archipelago.

The Onko Gibbon (*Sim. lar*, Lin.).—[This name is now by general consent applied to the next species, the present one being distinguished as *H. Raflesi*, Geof.] Black, with white hairs round the face.

[The Lar Gibbon of Linnaeus (*H. lar*, Geof.)—Black, with white hands and feet, and a white circle round the face. Is identical with *H. albitarsis*, Vig. and Horsf., and probably with *H. variegatus*, Kuhl, which seems to differ only in colour, being brown where the other is black.

The Hoolock Gibbon (*H. hoolock*, Harlan).—Black, marked with white across the forehead.

The Coromandel Gibbon (*H. coromandus*, Ogilby).—Of a dingy pale brown, with black hair and whiskers.]

The Wou-wou Gibbon (*S. agilis*, Lin.).—Brown, the circle round the face and lower part of the back, pale fulvous [with also some white around the visage]. The young are of a uniform yellowish white. Its agility is extreme; it lives in pairs, and its name *Wou-wou* is derived from its cry.

The Gray Gibbon (*S. leucisca*, Schreb.).—Gray, with dark crown, and white beard and whiskers; the visage black. It lives among the reeds, and climbs up the highest stems of the bamboos, where it balances itself by its long arms.

We might separate from the other Gibbons

The Siangang (*S. syndactyla*, Rafles), which has the second and third toes of the hind foot united by a narrow membrane, the whole length of the first phalanx [a character which now and then occurs in some of the others, but in the present species is constant]. It is wholly black, with the chin and eyebrows rufous [and the throat bare]; lives in numerous troops, which are conducted by vigilant and courageous chiefs, which, at sunrise and sunset, make the forest resound with frightful cries. Its larynx has a membranous sac connected with it.

[All the above are mild and gentle animals in domestication, of extremely delicate constitutions when brought to our climate].

The remaining Monkey-like animals of the ancient continent have the liver divided into several

\* It may be remarked generally, that, with the possession of formidable canines, *Quadrumanus* acquire a consciousness of their efficacy as weapons, which renders them impatient of that control, more particularly if based on fear, to which they had previously been submissive. Chastisement then excites their ire rather than affrights them; and if they cannot gratify their rage, they will pine and die. They require, in short, different treatment. An adult male Mandrill, which was long exhibited in London, would perform various feats indicative of intelligence, if bribed to do so by the offer of its favourite beverage. The notion that the species with prominent muzzles are therefore less intelligent, requires modification. The development of brain, in all the *Simiæ*, as compared with that of Man, is arrested at a particular stage of advancement; but it does not follow that

the growth of the other parts—that is, the development of the other systems—should cease simultaneously: on the contrary, this proceeds to a variable extent in different species, and the projection of the muzzle, with its accompaniments, appears to increase in proportion to the stature ultimately attained; so that the adults of the smaller species are, in this respect, analogous to partially developed specimens of the larger, which correspond in disposition until they acquire the strength and armature of which an instinctive knowledge prompts them to resent affronts, and renders them so highly dangerous to tamper with. The Baboons are even remarkable for penetration and quickness of apprehension, however short their temper.—Ed.

† Very highly improbable.—Ed.

lobes; the cæcum thick, short, [except in *Semnopithecus*, and perhaps *Colobus*], and without any appendage: the hyoid bone has the form of a shield.

THE MONKEYS\* (*Cercopithecus*, Erxl. in part), [*Guenons* of the French].—

Have a moderately prominent muzzle (of sixty degrees); cheek pouches; tail; callosities on the buttocks; the last of the inferior molars with four tubercles like the rest. Very numerous species of them, of various size and colouring, abound in Africa, living in troops, which do much damage to the gardens and cultivated fields. They are easily tamed, [and are lively and active animals. Their hair, unlike that of the preceding groups, is of two kinds, the outer commonly annulated above with two colours, producing a grizzled appearance, which in several imparts a tinge of green.

More than twenty species have been ascertained, and doubtless many others remain to be discovered. They vary in the proportional length of the fingers. The larger of them acquire, with their growth, a more projecting muzzle, and are the *Cercopithecids* of some naturalists (a term now falling into disuse): these, in a few instances, manifest an additional relationship to the Baboons, in exhibiting bright colours on the genitals; as exemplified by the Malbrouck Monkey (*C. cynosurus*), in which the scrotum is vivid ultramarine, and the Vervet (*C. pygerythrus*), which has the same part green. Many are prettily variegated, as the Diana Monkey (*C. Diana*), which has a crescent-shaped white mark on the forehead, and a slender, pointed, white beard; the Mona Monkey (*C. mona*), &c. One only is of a red colour, the Patas (*C. rubra*). A few of the more recently discovered of them may be briefly indicated.

Campbell's Monkey (*C. Campbelli*, Waterhouse.)—Hair long, and parted on the back, of a grizzled black and yellow colour, nearly uniform blackish grey on the hind parts; beneath, dingy white; a black line encircling the fore part and sides of the crown of the head. From Sierra Leone.

The Bearded Monkey (*C. pogonias*, Ben.)—Hair very long; greyish, i.e., grizzled black and yellowish white; a spot on each side of the head, another on the crown, and tip of the tail, black; cheeks furnished with an immense tuft of pale hair.

Red-eared Monkey (*C. erythrolis*, Waterh.)—Grey; the tail red, with a dark line along its upper surface; ears with very long red hairs internally; throat white; under parts of the body greyish. From Fernando Po.

Next follows a group of smaller species, of mild and confiding disposition; consisting of the Talapoin M. (*C. talapoin*, Geoff., *Sim. melanrhina*, F. Cuv.), the Moustache M. (*S. cephus*, Lin.), the Vaulting M. (*S. petawista*, Gm.), the Hocheur (*S. nictitans*, Gm.), &c. A new Monkey appertaining to it is the

*C. Martini*, Waterh.—Of a dark grey, the hairs annulated with yellowish white; lower portions of limbs, crown of the head, and tail, blackish; hairs near the root of the tail beneath, brown. Inhabits Fernando Po. Several of these smaller kinds are very common in Guinea. Allied to them are the larger green Monkeys; and the series terminates with the Mangabeys, or dusky-coloured white-eyelid Monkeys (*C. æthiops*, and *C. fuliginosus*), which display some peculiarities of gait and gesture, and have the most prominent muzzles of any.

The following occurs as a note in the original work. "Pennant has described certain *Guenons*"—*Doucs* rather—"without thumbs†, *Sim. polycomos* and *S. ferruginea*, of which Illiger has formed his genus *Colobus*, but I have not been able to see them, and for this reason have not introduced them. M. Temminck assures us that the head and teeth resemble those of a *Semnopithecus*." This group is now well established, and several species have been added to it; all of them, however, peculiar to Africa, as the members of the last-named genus are to Asia: they differ chiefly from the *Doucs* in possessing cheek-pouches, having the limbs similarly elongated, and only one sort of hair, as in the Apes. A small rudiment of a thumb exists in some of them.

Nine clearly distinct species have been ascertained; and there are probably many others. They resolve into two minor groups; the species composing the first are rather large animals, of a black ground-colour, with very long hair; those of the second division are smaller, with shorter hair, and rufous ground-colour. Their markings readily distinguish them.

The Black Colobin (*C. satanas*, Waterh.)—Quite black, with very long shaggy hair, obviously designed to protect it from the scorching rays of a vertical sun. This animal is common in Fernando Po, and when captured refuses to take sustenance, pining and moaning constantly and very piteously.

Ursine Colobin (*C. ursinus*, Ogilby.)—Black, with grey head and white tail. From Sierra Leone.

White-thighed Colobin? (*C. ? leucomeros*, Ogilby.)—Established on some imperfect skins. The thighs white; head, legs, and tail undetermined. From the Gambia.

*Sim. polycomos*, Pennant; termed by him the "Full-bottomed Monkey."—Has a long yellowish-white sort of mane, compared to a full-bottomed wig, and a white tail. Brought from Sierra Leone.

*C. guereza*, Ruppel.—The throat and around the face white; and long flowing white hair on the shoulders and along each side of the body, as if a garment were thrown over it; end of the tail also white, and largely tufted. From Abyssinia.

*C. rufoniger*, Ogilby.—Black above, deep red beneath; locality unknown.

\* The word *Monkey* is a diminutive of *Mon.*—En.

† The thumb is very small in the *Doucs*.—En.

*Sim. ferruginea*, Pennant; called by him the "Bay Monkey."—Of a deep bay colour above; cheeks and underparts very bright bay. From Sierra Leone.

*G. Pennantii*, Waterh.—Above blackish; beneath dingy yellow; the sides yellowish red and cheeks white. From Fernando Po.

Of rusty-red beneath, and on the cheeks; the sides yellow. From the [with *G. stans*, Ogilby.

The skins of these animals are an article of traffic in Western Africa, but are commonly deprived of the head, hands, and tail. Many *Cercopithecus* are prepared in the same manner.\*]

### THE DOUCS (*Semnopithecus*, F. Cuv.)—

Differ from the true Monkeys by having an additional small tubercle on the last of the inferior molars. They are the ordinary *Monkeys* of the East; and their lengthened limbs and extremely elongated tail [as in *Colobus*] give them a peculiar air. Their muzzle projects very little more than that of the Gibbons, and, like them, they have callosities on the buttocks; they appear, likewise, to have no

cheek-pouches: their larynx is furnished with a sac. [The stomach (fig. 3) is singularly complicated, consisting of three divisions; first, a cardiac pouch, with smooth and simple parietes, slightly bifid at the extremity; secondly, a middle, very wide and sacculated portion; thirdly, a narrow, elongated canal, sacculated at its commencement, and of simple structure towards its termination: their food, accordingly, is supposed to be more herbaceous than that of other *Catarrhini*, which is further intimated by the blunter tubercles of their molars, and the elongation of their intestines and cæcum. Their hair is of one kind only, approaching in character to that of the Gibbons. Their movements are staid and

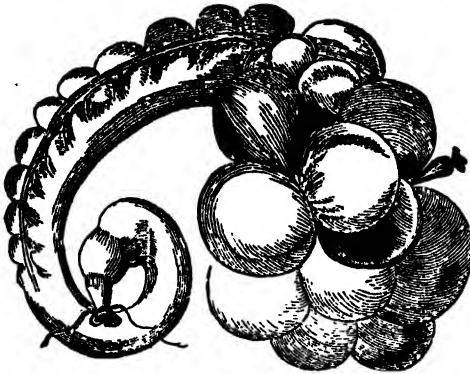


Fig. 3.

deliberate, though capable of much agility; and the gravity of their deportment is expressed by their systematic name.

Fourteen or fifteen species have been determined, of which the most extraordinary is]

The Long-nosed or Proboscis Douc (*Sim. nasica*, Schr.; *Nasalis larvatus*, Geof.†) [The *S. recurvus*, Vig. and Horsf., is apparently the young.]—It is of large size, and yellowish colour tinted with red; the nose extremely long and projecting, in form of a sloping spatula. This species inhabits Borneo, and lives in great troops, which assemble morning and evening on the branches of the great trees on the banks of the rivers; its cry is *Kahau*. Is stated also to occur in Cochin China.

The Variegated Douc (*S. nemous*, Geof.)—Remarkable for its lively and varied colouring: the body and arms are grey; the hands, thighs, and feet black; legs of a lively red; the tail, [fore-arm,] and a large triangular spot upon the loins, white; face orange; and there is also a black and red collar, and tufts of yellow hairs on the sides of the head. It inhabits Cochin China. (The genus *Lastopyga* of Illiger was founded on a mutilated skin of this animal.)

*S. entellus*, Dufres. [The species most frequently brought alive to Europe.]—Of a light yellowish grey colour, with black hair on the eyebrows and sides of the head, directed forwards. From Upper Bengal, where it is held in superstitious reverence. [Some frequent the Pagodas.

Several are black, dusky, or ash-coloured. *S. auratus*, Geof., is uniform bright golden yellow, with a black patch on each knee. The Simpai (*S. melalophus*, Cuv.) is of a very lively red; beneath white: its face is blue; and a crest of black hairs reaches from one ear to the other. Some have the hair of the head turned up, forming a sort of crest. All are from the islands of the Indian Ocean, and neighbouring regions of Asia.]

### THE MACAQUES (*Macacus*, Desm.)—

Possess, like the Doucs, a fifth tubercle on their last molars, and callosities and cheek-pouches like the true Monkeys. Their limbs are shorter and stouter than in the former; their muzzle is more elongated, and the superciliary ridge more prominent than in either the one or the other. Though docile when young, they become unmanageable with age. They have all a sac which communicates with

\* I have availed myself of this opportunity to give a more complete list of the *Colobus* than has hitherto been published.—Ed.

† The anatomy of this animal is now known to accord with that of the other Doucs.—Ed.

## QUADRU MANA.

the larynx under the thyroid cartilage, and which fills with air when they cry out. Their tail is pendent, and takes no part in their movements; [It varies in length from a tubercle to longer than the body.] They produce early, but are not completely adult for four or five years. The period of gestation is seven months; during the rearing season the external genital organs of the female are excessively distended [as in the Baboons]. Most of them [all] inhabit India and its Archipelago.

At least seven species have been ascertained, the most remarkable of which is:

The Maned Macaque or Wandering (Sim. *Silenus* and *leontus*, Lin.)—Black, with an ash-coloured mane and whitish beard surrounding the head. [Tail moderately long, and slightly tufted.] Inhabits Ceylon.

[The Bonneted Macaque (*M. discolor*), and the Togue (*M. radiatus*), have the hairs on the top of the head disposed as radii; these, with the Hare-lipped M. (*M. cynomolgus*), have long tails. In the Pig-tailed Macaque (*M. rhinoceros*), this appendage reaches little below the hamstrings: it is shorter, thin, and wrinkled in the Brown Macaque (*M. nemestrinus*); and in the Black M. (*M. niger*, Ben.; *Cynocephalus niger*, Desm., and of Cuvier's last edition), it is reduced to a mere tubercle. The Black Macaque is wholly of that colour, with an erect tuft of hair on the top of its head; its native country Celebes.]

### THE MAGOTS (*Inuus*, Cuv.)

More Macaques, which have a small tubercle in place of a tail. [According to this definition, the last-named species should be introduced here: the only known Magot, however, does not well range with the others; its cranium is intermediate to those of the *Macaci* and *Cynocephali*.]

The Barbary Magot (Sim. *syriacus*, *pithecus*, and *inuus*, Lin.)—Completely covered with greenish-brown hair. Of all the tribe, this suffers least in our climates. Originally from Barbary, it is said to have become naturalized on the Rock of Gibraltar.\* [This well-known species, in its wild state, is both lively and remarkably intelligent at all ages; but, subjected to the restraint of captivity, becomes sullen and unmanageable as it grows up; forcibly illustrating what has been stated in a note to the Orang-utans.]

### THE BABOONS (*Cynocephalus*, Cuv.),—

Together with the teeth, cheek-pouches, and callosities of the preceding, have an elongated muzzle abruptly truncate at the end, where the nostrils are pierced, which gives it a greater resemblance to that of a Dog than of other Monkeys; their tail varies in length. They are generally large, ferocious, and dangerous animals, of which the majority [all of them] inhabit Africa.

[Some have the tail long and tufted, as the Gelada Baboon (*Macacus gelada* of Ruppell).—This has the upper parts covered with very long hair, of a pale brown on the head, shoulders, and rump, blackish on the back; a dark medial line extends backwards from the forehead; the extremities are black. A native of Abyssinia.

The others have the hair grizzled or annulated. Such are the Tartarin Baboon (Sim. *hamadryas*, Lin.), of a slightly bluish ash-colour (grizzled black and white); face flesh-coloured: inhabits Arabia and Ethiopia. The Chacma B. (Sim. *porcaria*, Bodd.; *S. ursina*, Penn.; *S. sphyngioides*, Herm.), which is black, with a yellowish or greenish glaze, particularly on the forehead; the face and hands black, and the adult has a large mane. From the Cape of Good Hope. The Anubis B. (*C. anubis*, F. Cuv.), is another huge Cape species, uniformly grizzled black and yellow; the face black, and snout much elongated. The Sphynx B. (Sim. *sphynx*, Lin., and it would appear from descriptions, also, *C. papio*, Desm.), is likewise yellowish, more or less tinged with brown; face black; the cheek-tufts fulvous: inhabits Guinea. Lastly, the Babouin (Sim. *cynocephalus*, F. Cuv.), has a shorter tail, and coat more inclining to greenish; also whitish cheek-tufts, and flesh-coloured visage.]

### THE MANDRILLS —

Are, of all the Monkey tribe, those which have the longest muzzle (thirty degrees†); their tail is very short; they are also extremely brutal and ferocious; nose as in the others.

The Mandrill Baboon (Sim. *maimon* and *mormon*, Lin.)—Greyish brown, inclining to olive above; a small citron-yellow beard on the chin; cheeks blue and furrowed. The adult males have the nose red, particularly at the end, where it is scarlet; the genital parts and those about the anus, are of the same colour; the buttocks are of a fine violet. It is difficult to imagine a more hideous and extraordinary animal. It nearly attains the size of a Man, and is a terror to the negroes of Guinea. Many details of its history have been mixed up with that of the Chimpanzee, and consequently with that of the Orang-outang.

The Drill (Sim. *leucophaea*, F. Cuv.)—Yellowish grey, the visage black; in old ones the coat becomes darker; [the white hairs on the belly are much elongated], and the chin is bright red.

[Hideous as the animals of this genus appear, and disgustingly deformed to those who have only seen them in captivity, their adaptation to a peculiar mode of life is of course as exquisite as that of any other animal, and requires only to be understood to command an amount of admiration, which must lessen to a considerable

\* *Pithecus* is the Greek name for Monkeys in general; and the one of which the anatomy is given by Galen was a Magot, although Camper thought it was an Orang-outang. M. de Blainville perceived this mistake, and I have proved it by comparing with these two

species, all that Galen has stated respecting the anatomy of his *Pithecus*.

† The Orang-utans will bear comparison.—Es.

extent the abhorrence with which we are apt to regard them. It has lately been discovered that they chiefly inhabit barren stony places, where they subsist, for the most part, upon scorpions; to procure which they employ their hands to lift up the numerous loose stones, under most of which one or more of these creatures commonly lie concealed; their stings they extract with dexterity. Accordingly, we find that the Baboons are expressly modified for traversing the ground on all-fours, and are furnished with efficient hands; their eyes are peculiarly placed, directed downwards along the visage. Want of space necessarily prevents us, generally, from noticing these highly interesting relations, afforded by the special modifications of structure in reference to habit: but we avail ourselves of the present instance (which is little known\*) to call attention to them.

With the Baboons, the series of CATARRHINI (Geof.) terminates; and we may observe that the *Sithiade* fall under three principal divisions. First, that of the Apes, (comprising the Chimpanzee, Ourang, and Gibbons), tail-less genera, which have the liver divided as in Man, an appendage to the cœcum, &c. Second, the slender-limbed Monkeys, with sacculated stomachs and longer intestines (or the Doucs, and most probably the Colobins), all of which have exceedingly long tails. Third, those with shorter and stouter limbs, a simple stomach, and tail varying in length from a tubercle to longer than the body. These last (or the true Monkeys, Macaques, Magots, and Baboons), are all partly insectivorous; and the habit mentioned of the Baboons, of turning over stones in quest of prey, applies perhaps more or less to all of them, but particularly to the Magot and some Monkeys. In the two first divisions, the coat consists of only one sort of hair; in the last of two sorts, the longer and coarser of which is mostly annulated with two colours. It is remarkable that none of the genera are common to Asia and Africa (one Baboon only extending to Arabia), and, until very recently, no remains of any had occurred in a fossil state; but the jaw of one said to be allied to the Gibbons has lately been detected in a tertiary deposit, at Sanson, France; and some bones, adjudged to be those of Macaques, in the tertiary ranges of northern India.]

#### THE MONKEY-LIKE ANIMALS OF THE NEW WORLD,

##### [PLATYRRHINI, Geof.],—

Have four grinders more than the others, thirty-six in all; the tail [with very few exceptions] long; no cheek-pouches; the buttocks hairy and without callosities; nostrils opening on the sides of the nose, and not underneath; [the thumbs of the anterior hands no longer opposable†.] All the great *Quadrumana* of America pertain to this division.‡ Their large intestines are less inflated, and their cœcum longer and more slender than in the preceding divisions.

The tails of some of them are prehensile, that is to say, their extremity can twist round a body with sufficient force to seize it as with a hand.§ Such have been designated SAPAJOUS (*Cebus*, Erxl.)

At their head may be placed the

##### STENTORS (*Mycetes*, Illiger),—

Or *Howling Monkeys* [*Alouattes* of the French], which are distinguished by a pyramidal head, the upper jaw of which descends much below the cranium, while the branches of the lower one ascend very high, for the purpose of lodging a bony drum, formed by a vesicular inflation of the hyoid bone, which communicates with their larynx, and imparts to their voice prodigious volume and a most frightful sound. Hence the appellations which have been bestowed on them. The prehensile portion of their tail is naked beneath.

[The Rufous Stentor (*Sim. seniculus*, Buff., Supp. vii. 26), the Urine Stentor (*Stentor urinus*, Geoff.), and at least five other species, are now tolerably established. They are shaggy animals, averaging the size of a Fox, of different shades of brown or blackish, the females of some being differently coloured from the males; such is *M. barbatus*, Spix, pl. 32, of which the male is black and bearded, the female and young pale yellowish-grey.¶ They are of an indolent and social disposition, and grave deportment; utter their hideous yells and howling by night; subsist on fruits and foliage, and are deemed good eating.]

\* For the information communicated, we are indebted to Dr. A. Smith, the conductor of the South African expedition from the Cape colony.—En.

† They are but slightly so in many of the *Sithiade*.—En.

‡ By this is meant, that the Marmosets and Tamarins (*Ouletis* of our author) are excluded from the generalisation.—En.

§ This organ possessing in an eminent degree the sense of touch, where the character is most developed.—En.

¶ Cuvier accordingly suggests, inadvertently, that the *M. stramineus*, Spix, pl. 31, which is entirely of a straw-yellow colour, may be the female of some other; Spix, however, figures a male.—En.



The ORDINARY SAPAJOUS have the head flat, the muzzle but slightly prominent (sixty degrees).

In some the anterior thumbs are nearly or quite hidden in the skin, and the prehensile portion of the tail naked beneath. They constitute the genus

COAITA (*Ateles*, Geof.),—

[Or the *Spider Monkeys*, as they are commonly termed, in allusion to their long slender limbs, and sprawling movements.]

The first species, the Chamek (*A. subpentadactylus*, Geof.), has a slight projection of the thumb, though only for one phalanx, which has no nail. Another, the Mikhri (*A. hypoxanthus*, Fr. Max.; *Brachyteles macrotarus*, Spix), has also a very small thumb, and sometimes even a nail. These two species are separated by Spix under the name *Brachyteles*. They connect *Ateles* with *Lagothrix*.<sup>a</sup>

The others, to which alone Spix applies the name *Ateles*, have no apparent thumb whatever. [Six have been ascertained; one of them the *Sim. paniscus*, Lin.]

All the above are natives of Guiana and Brazil. Their limbs are very long and slender, and their gait slow and deliberate. They exhibit some remarkable resemblances to Man in their muscles, and, of all animals, alone have the biceps of the thigh made like his. [Accordingly, they make little use of their fore-hands in progression. Their colours are chiefly or wholly black, or fulvous-grey; face black, or flesh-coloured. They are gentle and confiding, and capable of much attachment. Some attain to as large a stature as the preceding.]

THE GASTROMARGUES (*Lagothrix*, Geof.; *Gastromargas*, Spix).

Head round, as in the Coaitas; the thumb developed, as in the Stentors; and tail partly naked, like the one and the other. Such are—

The Caparo, Humb. (*L. Humboldtii*, Geof.; *G. olivaceus*, Spix), and the Grison (*L. canus*, Geof.; *G. infumatus*, Spix).—Inhabitants of the interior of South America, said to be remarkable gluttons. Their limbs are shorter and stouter than in the Coaitas, and they often raise themselves on their hinder extremities: occur in numerous bands.

The other Sapajous, or

THE CAPUCHINS (*Cebus*, Geof.).—

Have a round head, the thumbs distinct, and the tail entirely hairy, though prehensile. The species are still more numerous than those of the Stentors, and almost as difficult to characterize.

Some have the hair upon the forehead of a uniform length; as the Sajou (*Sim. apella*, Lin.), and the Capuchin, [Auct.] (*S. capucina*, Lin.): others have the hair of the forehead so disposed as to form aigrettes; as the Horned Capuchin (*Sim. fatuellus*, Gm.), which has a tuft of black hairs on each side of the forehead, the *C. cirrhifer*, Geof., and the *Cebus* of the same name of Fr. Max., but which is different—*C. cristatus*, F. Cuv. There are numerous others; but we require many observations, made in the places where these animals inhabit, before we can hope to establish their species otherwise than in an arbitrary manner. [About sixteen are commonly admitted, most of which are of different shades of brown, some very variable. They are of smaller size than the preceding, and of mild and gentle disposition; their motions are quick and light, and they are easily tamed. Several exhale a strong odour of musk.]

In the SAIMIRI†, the tail is depressed, and almost ceases to be prehensile; the head is very much flattened; in the interorbital partition of the cranium there is a membranous space. Only one species is known,—

The Saimiri (*Sim. sciurea*, Buff. xv. 10).—Size of a Squirrel; of a yellowish grey; the fore-arms, legs, and the four extremities, of a fulvous-yellow; end of the nose black. [A pretty, vivacious little animal, which subsists much on insects, and is also carnivorous. Its tail is sub-prehensile, or capable of coiling slightly throughout its length, and so holding in a moderate degree; but its extremity cannot seize a small object: it is often wound round the body.]

The remaining Monkey-like animals of America have the tail not at all prehensile.‡ Several have that appendage very long and tufted, whence they have been termed *Fox-tailed Monkeys*: their teeth project forwards more than in the others. They are

THE SAKI (*Pithecia*, Desm. and Illig.),—

[Which are again divisible into three minor groups. Of these, the first is represented by the Yake Saki (*Sim. Pithecia*, Lin., *P. leucocephala*), and three or four others: singular-looking animals, with extremely long hair, except on the head, where, in most of the genus, it is parted. In the Yake, the head is whitish, and all the other parts brown-black, which adds to the strangeness of its appearance. The Jacket Saki (*Sim. sagueta*, Traill), illustrates

<sup>a</sup> The latter may do so, but certainly not the former, which is in all other respects a characteristic *Ateles*.—Ed.

† *Saguinus* (or, what would be preferable, *Saguinus*) of some. This name, however, originally proposed by Ledeboer for the *Saguinus*, (*Callithrix*), among which the Saimiri was included, can only lead to

confusion if applied to the latter exclusively. We would suggest, therefore, the appellation *Saimiri*, formed out of the vernacular.—Ed.

‡ It has a propensity to curl in the Marmosets, if not in the *Saguinus*.—Ed.



the next group, which chiefly differs from the third (*Brachyurus*, Spix), in possessing a long tail: the hair is comparatively short, and in the Jacket Saki of a rich dark brown, except on the head, where it is longer, crisped, and deep black, as is also its fine bushy beard. Others would appear intermediate, as the *P. satanas*, Humb.: seemingly allied to which is the *Brachyurus israelitus* of Spix, and the diminutive *P. melanocephala* of Humboldt.\* These last are represented as mainly frugivorous, and the first to be great destroyers both of wild bees and their honey. They are said to inhabit the very depth of the forest, and to repose during mid-day; are moderately social, and crepuscular if not nocturnal in their time of action.]

There are also some,

#### THE SAGOUINS (*Callithrix*, Geof.),—

The tail of which is slender, and the teeth do not project. They were a long time associated with the Saimiri, but the head of the Sagouins is much higher, and their canines considerably shorter. Such are

The Masked Sagouin (*C. personata*, Geof.), the Widow Sagouin (*C. lugens*, Humb.), [and several others; some of which have been ascertained to live in pairs, while others, (as the *C. melanochtr*, Fr. Max.), assemble in numerous bands, and make a loud and unpleasant yelping about sunrise. They are very carnivorous, though small, and spring to a considerable distance on birds and other prey, for which they lie in wait; are also dexterous in seizing flying insects with the hand. They have none of the sprightliness of the Saimiri.]

THE DOUROUCOLI (*Nocthorus*, F. Cuv.; *Nyctipithecus*, Spix: improperly named *Lotus* by Illiger),— Only differ from the Sagouins by their great nocturnal eyes, and in their ears being partly hidden under the hair.

[Three species are now known, of somewhat Lemur-like appearance, but still having no particular relationship with the Lemura. They are almost lethargic by day, which they pass in the darkest recesses of the hollows of trees; but at night are all energy and activity, and subsist on small birds and insects, as well as fruit: they drink little, and appear to live in pairs.]

All the foregoing animals are from Guiana or Brazil.

#### THE OUISTITIS (*Hapale*, Illiger),—

Constitute a small genus, similar to the Sakis, and which was long confounded in the great genus *Simia*. They have, in fact, like the American Monkey-like animals in general, the head round, visage flat, nostrils lateral, the buttocks hairy, no cheek-pouches; and, like the latter divisions of them in particular, the tail not prehensile: but they have only twenty grinders, like those of the old continent. All their nails are compressed and pointed, except those of the hinder thumbs [a character to which the immediately preceding divisions approximate], and their anterior thumbs are so little separated from the other digits, that we hesitate to apply the name *Quadrumana* to them. All are diminutive animals of pleasing forms, and are easily tamed. [Their brain is surprisingly low, almost without convolutions.]

M. Geoffroy distinguishes the *Ouistitis*, properly so called, by the name *Jacchus*. They are the

#### MARMOSETS (*Hapale*, as restricted),—

Which, for characters, have the inferior incisors pointed, and placed in a curved line, equalling the canines. Their tail is annulated, and well covered with hair; and their ears are generally tufted.

[Seven or eight species are tolerably established, some of which are subject to vary. These pretty little creatures are gregarious, and very indiscriminate feeders; are indeed rapacious, and in confinement will eagerly seize and prey on gold fishes, &c. They produce two or three young at a birth.]

M. Geoffroy designates as

#### TAMARINS (*Midas*),—

Those species which have inferior trenchant incisors placed in an almost straight line, and shorter than the canines. Their tail is also more slender, and not annulated.

[These differ more than the others, and are also somewhat variable in colour. At least seven or eight have been ascertained, of which the Pinche (*Sim. adipus*, Lin.), is the longest known. Those curious little beings, the Silky Tamarin (*M. rosalia*), and the Leoncito, or Lion Monkey of Humboldt (*M. leoninus*), fall under this division.

\* It is probable that all but the members of the first should range in the division *Brachyurus*, Spix, (provided this be separable,) which name is consequently ill-chosen.—Ed.

All are restlessly active, and extremely rapid in their movements; also remarkably short-tempered, bristling with fury when enraged, and putting on a most formidable appearance, considering their size. They are so cleanly, that any appearance of dirt about their habitations causes them to fret; and are exceedingly sensitive of damp: but, if duly attended to, are easily kept in captivity.

The PLATYRRHINI were very properly ranged by Buffon in two great natural divisions, named by him SAPIJOUS and SAGOUINS; to the latter of which the *Ouistitis* are strictly referable, to judge from the aggregate of their conformation. We cannot but think that Cuvier has, in this rare instance, attached undue importance to the number of molar teeth, in so decidedly separating the *Ouistitis* from the other small American *Quadrumana*.]

# THE LEMURS, (*Lemur*, Linn.),

[STREPSIRRHINI, Geoff.],—

Comprehend, according to Linnæus, all the *Quadrumana* which have [supposed] incisors in either jaw differing in number from four, or at least otherwise directed than in the Monkeys. This

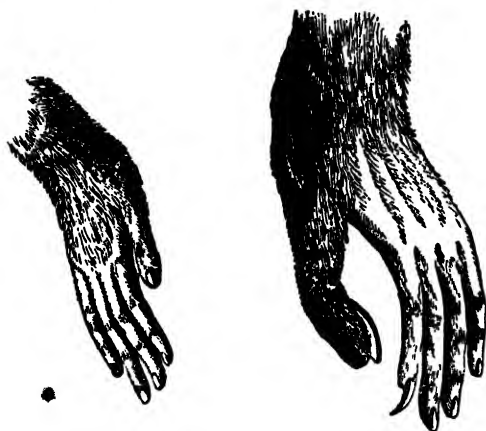


Fig. 4.—Hand and Foot of Lemur

negative character could not fail to embrace very different beings, while it did not unite those which should range together. M. Geoffroy has established several better characterized divisions in this genus. The four thumbs of these animals are well developed and opposable, and the first hind finger is armed with a raised and pointed claw (fig. 4), all the other nails being flat. Their covering is woolly; and their teeth begin to exhibit sharp tubercles, catching in each other, as in the *Insectivora*. [These animals have been described to differ from all other *Mammalia* in the circumstance of their upper canines locking outside or before the lower: but we have

just discovered that their true inferior canines have always hitherto been mistaken for additional incisors, which they resemble in general aspect and direction; while the succeeding tooth, which from its size and appearance has been supposed to be the lower canine, is in reality the first false molar; (as will readily appear on opposing the successive teeth of both jaws). In the genus *Tarsius*, however, the true canine assumes more of its ordinary form; and the same is observable of the first false molar in *Microcebus*.\* The grinding motion of the lower jaw is exceedingly reduced.]

# THE LEMURS, properly so called (*Lemur*, as restricted [*Prosimia*, Briss.]),—

Have six [four] lower incisors, compressed, and slanting forwards [as are also the canines]; four in the upper jaw, which are straight, those intermediate being separated from each other; trenchant [upper] canines; six molars on each side above, and six below†; the ears small. They are very nimble animals, and have been designated *Fox-nosed Monkeys*, from their pointed heads. They subsist on fruits. Their species are very numerous, and inhabit only the island of Madagascar, where they appear to replace the Monkey-tribe, which, it is said, do not exist there. They differ but slightly among themselves, except in colour.

[Thirteen, at least, have been ascertained definitively; one of the longest known of which is the Macaco of Buffon, or the Ring-tailed Lemur (*L. catta*, Lin.), which is ash-grey, the tail annulated black and white. Others are black, or rufous, with sometimes white; and one beautiful species, the Ruffed Lemur (*L. macaco*, Lin.), is

\* An approach to this deviation on the part of the inferior canine is noticeable in the adult Mandrill.—Ed.

† The latter statement chances to be correct, but, as intended would have been erroneous.—Ed.

varied with large patches of black on a pure white ground. They average the size of a large Cat, but have longer limbs; and have all long tails, which are elevated in a sigmoid form, when in motion, and not trailed after them. They are nocturnal or twilight animals, which sleep by day in a ball-like figure, perched on a bough; are gentle in disposition, and easily tamed; but have much less intelligence than the Monkeys, and are without the prying, mischievous propensities of those animals: their ordinary voice is a low grunt, but they often break forth into a hoarse abrupt roar, producing a startling effect; in their native forests they frequently thus roar in concert.]

#### THE INDRI (*Lichanotus*, Illiger)—

Have teeth as in the preceding, except that there are only four [two] lower incisors [the central probably soon falling. Their hinder limbs are extremely long; the head broad, muzzle short, and hands long.]

But one species is known, without tail [this appendage being reduced to a tubercle], three feet in height, black, with the face grey, and white behind (*Lemur indri*, Lin., *Indris brevicaudatus*, Geoff.), which the inhabitants of Madagascar tame, and train to the chase like a Dog. The Long-tailed Indri (*Lemur laniger*, Gm.) needs further examination.

[The latter appears to be very intimately allied to a species, with a naked face, named *Propithecus diadema* by Bennett, (*Macromys typicus*, Smith,) the systematic characters of which seem hardly to warrant its separation from the Indris. Both are natives of Madagascar, and it is doubtful whether the present genus should not precede the last. The Short-tailed Indri is the most human-like of its tribe.

#### THE MACAUCUS (*Microcebus*, Geoff., *Galagoides*, Smith)—

Have the head round; muzzle short and pointed; ears moderate and erect; the fore-limbs small: four incisors above, the central larger; also four below, with similar projecting canines, as in *Lemur*; the upper canines are small and pointed; and the first inferior false molar is scarcely larger than the next: the cheek-teeth indicate a partly insectivorous regimen. Their scrotum is disproportionately large.

Two small species are known: the Murine Macauco (*Lemur murinus*, Pen.), which is Buffon's *Rat of Madagascar*; and the Brown Macauco (*M. pusillus*, Geoff.; also *Galago madagascariensis*, Geoff., *G. demidoffi*, Fischer, and *Otolionus madagascariensis*, Schinz). The *Lemur cinereus*, Geoff. and Desm. (*Petit Maki*, Buff.), may perhaps constitute a third. These little animals have much the aspect, and also the manners, of a large Dormouse, which they further resemble in nestling in the holes of trees, which serve them for a dormitory: during day they sleep rolled up in a ball, and only rouse from their torpor on the approach of twilight, but are then extremely agile and lively. Of their habits in a state of nature we know little, except that they are arboreal.]

#### THE LORIS (*Stenops*, Illiger)—

Have the teeth of the Lemurs, except that the points of their grinders are more acute; the short muzzle of a mastiff; body slender; no tail; large approximating eyes; the tongue rough. They subsist on insects, occasionally on small birds or quadrupeds, and have an excessively slow gait: their mode of life is nocturnal. Sir A. Carlisle has found that the base of the arteries of the limbs is divided into small branches, [anastomosing freely with each other,] as in the true Sloths, [the object of which appears to be to enable them to sustain a long continuance of muscular contraction. The same character occurs, however, in the *Cetacea*.]

Only two species are known, both from the East Indies; the Short-limbed Loris (*Lemur tardigradus*, Lin.), and the Slender Loris (*L. gracilis*): the former has been made a separate genus of by Geoffroy, who styles it *Nycticebus*; but he is wrong in asserting that it has only two incisors in the upper jaw: the latter is remarkable for the disproportionate elongation of its limbs, and especially of its fore-arms. [These most singular animals are eminently nocturnal and arboreal, being incommoded by daylight; they are also very susceptible of cold, which makes them dull and inanimate. During the day, they sleep clinging to a branch, with the body drawn together, and head sunk upon the chest; at night they prowl among the forest boughs in quest of food. Nothing can escape the scrutiny of their large glaring orbs: they mark their victim, insect or bird, and cautiously and noiselessly make their advances towards it, until it is within the reach of their grasp; they then devour it on the spot, previously divesting it, if a bird, of its feathers. When rousing from their diurnal slumbers, they delight to clean and lick their full soft fur; and in captivity will then allow themselves to be caressed by those accustomed to feed them: they are remarkable for extreme tenacity of grasp.

#### THE PORROS (*Perodicticus*, Bennett)—

Have comparatively small eyes; the ears moderate and open: dentition approaching that of the Lemurs; tail moderate; limbs equal; the index finger of the anterior hands (fig. 5) little more than rudimentary.



Fig. 5.—Hand of Potto.

Geoffroy's Potto. (*Lemur potto*, Lin.; *Galago crassicaudatus*, Geoff. P. Geoffroy, Ben.).—From Sierra Leone; a slow-moving and retiring animal; which seldom makes its appearance but in the night-time, and feeds on vegetables, chiefly the Cassada.]

#### THE GALAGOS (*Otolenus*, Illig.)—

Have the teeth and insectivorous regimen of the Loris; the tarsi elongated, which gives to their hinder limbs a disproportionate extent; tail long and tufted; large membranous ears [which double down when at rest, as in some Bats]; and great eyes, which indicate a nocturnal life. [The index, as well as the thumb of the anterior hand, inclines in some to be opposable to the other fingers.]

Several species are known, all from Africa; as the Great Galago (*Galago crassicaudatus*, Geoff.), as large as a Rabbit; and the Senegal Galago (*G. Senegalensis*, Geoff.), the size of a Rat. The latter is known as the Gum animal of Senegal, from its feeding much on that production. [These pretty animals have at night all the activity of birds, hopping from bough to bough, on their hind limbs only. They watch the insects flitting among the leaves, listen to the fluttering of the moth as it darts through the air, lie in wait for it, and spring with the rapidity of an arrow, seldom missing their prize, which is caught by the hands. They make nests in the branches of trees, and cover a bed with grass and leaves for their little ones: are a favourite article of food in Senegal. A species larger than the others has lately been received alive, *O. Garnottii* of Ogilby.]

#### THE MALMAGS (*Tarsius*)—

Have the tarsi elongated (fig. 6), and all the other details of form as in the preceding; but the interval between their molars and incisors is occupied by several shorter teeth [that is, their upper canines are very small; and] the middle upper incisors are elongated, and resemble canines. [There are but two permanent lower incisors, and the inferior canines present more of the ordinary form and direction.] Their muzzle is very short, and their eyes still larger than in any of the foregoing. [Tail very long, and almost naked.] Are also nocturnal animals, and insectivorous; inhabiting the Mollucas.



Fig. 6.—Foot of the Malmag.

[Two species are known, *T. spectrum*, Geoff., (*Lemur tarsius*, Shaw; *T. fuscomanus*, Fischer,) and the *T. bancanus* of Horsfield. It is observed by Geoffroy that although the Malmags have the external ears much less developed than in the Galagos, this inferiority is counterbalanced by the far greater volume of the auditory bullae of the temporal bones, which are so developed as to touch each other; and thus the sense of hearing is, by another mode, rendered as acute in the former as in the latter. The Malmag has an aversion to light, and retires by day under the roots of trees; feeds chiefly on lizards, and leaps about two feet at a spring; is easily tamed, and capable of some attachment; holds its prey in its fore-hands, while it rests on its haunches; produces one young at a birth, and lives in pairs.]

Travellers should search for certain animals figured by Commerson, and which Geoffroy has engraved (*Ann. Mus.* xix. 10), under the name of

#### CHEIROGALES (*Cheirogaleus*).

These figures seem to announce a new genus or subgenus of *Quadrumana*. [Three species are represented in Commerson's drawing, all of which appear to be now authenticated by specimens. Their proportions are those of the Galagos; dentition as in the Malmags, except that they retain all their inferior incisors; the head is round, the nose and muzzle short, lips furnished with whiskers, the eyes large and approximate, and the ears short and oval; the nails of the four extremities are compressed and somewhat claw-like, and the tail is long, bushy, and regularly cylindrical.

Three or more species are known, all from the great island of Madagascar. They constitute the division *Lichance* of Gray.

The singular genus *Cheiromys*, also, from the same peculiar locality, which is arranged by the author among the *Rodentia*, would appear to have much better claim to be introduced here, and near

## THE THIRD ORDER OF MAMMALIANS,—

### CARNARIA †,—

Consists of an immense and varied assemblage of unguiculated quadrupeds, which possess, in common with Man and the *Quadrumana*, the three sorts of teeth, but have no opposable thumb to the fore-feet.‡ They all subsist on animal food, [some Bats excepted,] and the more exclusively so, as their grinders are more cutting. Such as have them wholly or in part tuberculous, take more or less vegetable nourishment, and those in which they are studded with conical points live principally upon insects. The articulation of their lower jaw, directed crosswise, and clasping like a hinge, allows of no lateral motion, but can only open and shut: [the latter, however, had already been nearly lost in the Lemurs.]

Their brain, though still tolerably convoluted, has no third lobe, and does not cover the cerebellum, any more than in the following families; the orbit is not separated from the temporal fossa in the skeleton §; the skull is narrowed, and the zygomatic arches widened and raised, in order to give more strength and volume to the muscles of the jaws. Their predominant sense is that of smell, and the pituitary membrane is generally spread over numerous bony laminæ. The fore-arm is still capable of revolving in nearly all of them, though with less facility than in the *Quadrumana*. The intestines [save in the frugivorous Bats] are less voluminous, on account of the substantial nature of the aliment, and to avoid the putrefaction which flesh would undergo in a more extended canal: [besides which, the requisite nutriment is more readily extracted from it.]

As regards the rest, their forms and the details of their organization vary considerably, and occasion analogous differences in their habits||, insomuch that it is impossible to arrange their genera in a single line; and we are obliged to form them into several families, which are variously connected by multiplied relations.

Here, at the end of the *Quadrumana*, may be appended some information, which unfortunately arrived too late for insertion under the generic heads *Cercopithecus* and *Colobus*.

It has just been ascertained, by Mr. Martin, that the *MANGABEYS* (*Cercopithecus atropis* and *fuliginosus*, Auct.) possess the additional tubercle on the last molar, found in the *Macacques*, *Doucs*, &c.; whence the name *Cercopithecus* may now be continued to them exclusively, as a definite subordinate group, more nearly related to the true *Monkeys* than to the *Macacques*, notwithstanding the structural character adverted to. Their hair, it may be remarked, is not grizzled or annulated, as in both the *Macacques* and *Monkeys*.

Of the genus *Colobus*, a perfect skin of *C. leucoceros*, Ogilby, has been received in Paris, which securely establishes that species. The face is encircled with white hair, very long on the sides; and the tail also is white, as in *C. verreauxi*.

Finally, a notice and figure have been just published of a species designated *Colobus verreauxi*, but which appears to me, both from its contour and the description (which states its hair to be annulated), to be a thumbless *Cercopithecus*, allied to *C. Campbellii*. The negative

character of wanting a thumb, only, will not constitute a *Colobus*. —ED.

† Written *Carnassiers* by Cuvier.—ED.

‡ In one genus of *Cheiroptera* (*Dysops*), the hinder thumbs of some of the species incline to be opposable; while the last trace of this character in the anterior limbs, would seem to be the freedom of the thumb in the Bats generally, their fingers being all connected by membrane.—ED.

§ At least not generally; but it is commonly so in the *Mangoustes* (*Herpestes*), and allied genus *Cynictes*; also in the *Felis planiceps*; it is nearly so in the frugivorous *Cheiroptera*, and, it would seem, in *Taphozous* among the insectivorous Bats.—ED.

|| This is a favourite mode of expression of our author; but we have reason rather to transpose the sequence, or, in other words, to regard the habit as necessitating the particular modifications of structure. Thus, on consideration, it will appear, that the productive powers of nature ever exceeding the actual demand for such multiplication, species upon species have been endowed with the necessary organization to aid as successive checks upon

# THE FIRST FAMILY OF CARNARIA,—

## CHEIROPTERA,—

Preserves some affinities with the *Quadrupana* by the pendulous penis\*, and mammae which are placed on the breast. Their distinctive character consists in a fold of the skin, which, commencing at the aides of the neck, extends between their four feet and their fingers, sustains them in the air, and even enables such of them to fly as have the hands sufficiently developed for that purpose.† This disposition required strong clavicles, and large scapulars, to impart the requisite solidity to the shoulder; but it was incompatible with the rotation of the forearm, which would have diminished the force of the stroke necessary for flight. These animals have all four large canines, but the number of their incisors varies. They have long been distributed into two genera, according to the extent of their organs of flight‡ [sustaining membrane]; but the first requires numerous subdivisions.

## THE BATS (*Vespertilio*, Lin.)—

Have the arms, fore-arms, and fingers excessively elongated, so as to form, with the membrane that occupies their intervals, real wings, the surface of which is equally or more extended than in those of Birds. Hence they fly very high, and with great rapidity.

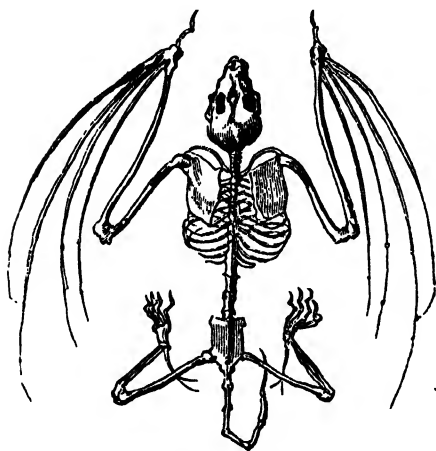


Fig. 7.—Skeleton of Bat.

Their pectoral muscles have a thickness proportioned to the movements which they have to execute, and the sternum possesses a medial ridge to afford attachment to them, as in Birds. The thumb is short, and furnished with a crooked nail, by which these animals creep and suspend themselves. Their hinder parts are [generally] weak, and divided into five toes, nearly always of equal length, and armed with trenchant and sharp nails. They have no cœcum to the intestine. Their eyes [except in the frugivorous species] are extremely small, but their ears are often very large, and constitute with the wings an enormous extent of membrane, almost naked, and so sensible that the Bats guide themselves through all the intricacies of their labyrinths, even after their eyes have been removed, probably by the sole diversity of aerial impressions.§ They are nocturnal animals, which, in

our climates, pass the winter in a torpid state. During the day they suspend themselves in

superfidity, it being clear, speaking generally, that the consumed must have pre-existed to the consumer; or, to embody the proposition in still more general terms, the conditions must have been first present, in especial reference to which any species has been organized: in conformity with which theorem, it may be remarked, that, however reciprocal, on a superficial view, may appear the relations of the prey and the prey, a little reflection on the observed facts suffices to intimate that the relative adaptations of the former only are special, those of the latter being comparatively vague and general; indicating that there having been a superabundance which might serve as nutriment, in the first instance, and which, in many cases, was unattainable by ordinary means, particular species have therefore been so organized (that is to say, modified upon some more or less general type or plan of structure,) to avail themselves of the supply; which special adaptation, however, does not necessarily prevent them (in a vast proportion of cases) from also deriving nourishment from

other sources. Hence, therefore, the organisation should be considered as having reference to, rather than as occasioning the particular habit.—Ed.

\* This organ, however, as in the *Carnivora*, contains a bone (though only within the glans,) with its accompanying pair of muscles.—Ed.

† This character applies to all, with the exception of the *Colugo* (*Galeosiphon*), a genus which has little claim to range in this division.—Ed.

‡ This term is inapplicable to the *parachute* membrane of the *Colugo*.—Ed.

§ I have reason to suspect that the delicate tact alluded to resides principally in the facial membrane, present in only some genera. A specimen of *Pteropus* *Nattereri*, which I have just been observing, (in which restricted genus there is no development of membrane on the face,) has several times, in flying about the room, stopped against a

obscure places. Their ordinary produce is two young at a birth, [one only in the frugivorous species, and many others,] which cling to the mammae of their parent, [have their eyes closed for a while,\*] and are of large proportional size. They form a very numerous genus, presenting many subdivisions. First there require to be separated—

#### THE ROUSSETTES (*Pteropus*, Briss.),—

Which have cutting incisors to each jaw, and grinders with flat crowns, or rather the latter have originally two longitudinal and parallel projections, separated by a groove, and which wear away by attrition: accordingly they subsist in great part upon fruits, of which they consume a vast quantity; they also ably pursue small birds and quadrupeds: [a statement which much requires confirmation.] They are the largest of the tribe, and their flesh is eaten. The membrane is deeply emarginated between their legs, and they have little or no tail; their index finger, shorter by half than the middle one, possesses a third phalanx, bearing a short nail (see fig. 9), which are wanting in other Bats; but the following fingers have each only two phalanges; [their thumb is proportionally very large]; they have the muzzle simple, the nostrils widely separated, the ears middle-sized and without a tragus, and their tongue studded with points that curve backwards; their stomach is a very elongated sac, unequally dilated, [and their intestines are much longer than in other Bats.] They have only been discovered in the south of Asia and the Indian Archipelago; [now, however, also in Japan, Australia, Madagascar, and the south and west of Africa.

The species are very numerous, and have been greatly elucidated by the investigations of Temminck and others, who have established most of them on a considerable number of specimens of all ages, and many anatomically. They produce early, and the sexes are separately gregarious, the young also associating apart from their parents as soon as they can provide for themselves.†] They divide into

1. Tailless Roussettes, with four incisors to each jaw; all of which were comprehended by Linnæus under his *Vespertilio vampyrus*. [More than twenty species are known, some of which exceed five feet across. One of the commonest in collections is]

The Black-bellied Roussette (*Pt. edulis*, Geof.)—Of a blackish brown, deeper beneath [the fur crisp and coarse]; nearly four feet in extent [sometimes, according to Temminck, upwards of five feet French, corresponding to five feet and a half English]. It inhabits the Moluccas and Isles of Sunda, where they are found during the day suspended in great numbers to the trees.

To preserve fruit from their attacks, it is necessary to cover it with nets. Their cry is loud, and resembles that of a Goose. They are taken by means of a bag held to them at the end of a pole; and the natives esteem their flesh a delicacy; but Europeans dislike it on account of its musky odour. The flesh of the Common Roussette (*Pt. vulgaris*, Geof.), an inhabitant of the Mauritius, has been compared to that of the Hare and Partridge.

2. Roussettes with a short tail, and four incisors to each jaw: [also generally less than the smaller species of the preceding. At least six are known, one of which only (*Pt. amplexicaudatus*), has the tail moderately conspicuous: the muzzle is comparatively somewhat shorter. These two divisions comprehend all that are now ranged in *Pteropus*; and one species only (*Pt. macrocephalus*, Ogilby), from the Gambia, presents any marked departure from the general character, in the great size of its head, the superior magnitude and solidity of its

canines, and separation of the molars: allied to it is *Pt. gambianus*, Ogilby, from the same locality, and *Pt. Whitei*, Ben., which has a singular tuft on each side of the neck. The name *Epomophorus*, Bez., is applied to these three species by Gray.]



Fig. 8.—Head of *Pteropus edulis*.

3. According to the indicia of M. Geoffroy, we now separate from the Roussettes

#### THE CEPHALOTS (*Cephalotes*, Geof.),—

Which have [nearly] similar grinders, but in which the index finger, short, and consisting of three

\* Perhaps the frugivorous species form an exception to this. The others are naked at birth, but have the limbs strong, and adapted for clinging to their parent.

† The same appears to be the case with some of the insectivorous Bats of Europe.—Ed.

phalanges, like that of the preceding, has no nail. The membranes of their wings, instead of meeting at the flank, are joined to each other at the middle of the back, to which they adhere by a vertical and longitudinal partition [a character which occurs, however, more or less completely, that is, the volar membrane is attached more or less near to the middle of the back, in some of the Roussettes]. They have often only two incisors [when adult, which are inserted in small curved intermaxillaries, that are moveable backwards and forwards].

"M. Isidore Geoffroy, in a monograph of this genus [*Pteropus*], forms the *Pt. personatus*, Tem., and some allied species, into the subgenus *Pachysoma*, which has four molars less than the others, and the zygomatic arches more projecting: the *Pt. minimus* or *rostratus* composes his subgenus *Macroglossus*, the muzzle of which is longer and more slender, and there are spaces between the grinders; it is believed that the tongue is extensile [now known to be slightly so, and of a rather longer and more acuminate form than in the others]. Lastly, he separates the Cephalot of Peron from that of Pallas, and applies to the former the name *Hypodermis*, on account of the complete dorsal insertion of the membranes of its wings."\*

[M. Temminck, in his excellent monograph of the *Pteropidae*, or frugivorous Bats (published in 1835), adopts, as generic, the divisions *Pteropus*, *Pachysoma* (*Cynopterus*, F. Cuv.), *Cephalotes*, Geoff. (*Hypodermis*, Is. Geoff.), *Harpyia*, Illiger (*Cephalotes*, Is. Geoff.), and *Macroglossus*.† Six species are known of *Pachysoma*, which present some other peculiar characters, and vary in size from ten to twenty inches across: the remaining three respectively consist of one known species only, viz., *C. Peronii*, sometimes two and a half feet in extent,—*H. Pallasii* (fig. 9), a singular looking animal, from Timour, fourteen inches across, with a claw on its fore-finger (like the Cephalot), and projecting tubular nostrils,—and *M. rostratus*, the Kiodote, the smallest of the tribe, rarely measuring a foot in spread of wing, and which is known to subsist chiefly on the fruit of the Clove (*Eugenia*); its grinders are remarkably diminutive. Between these frugivorous *Cheiroptera* and the following genera, the lapse is very considerable.]

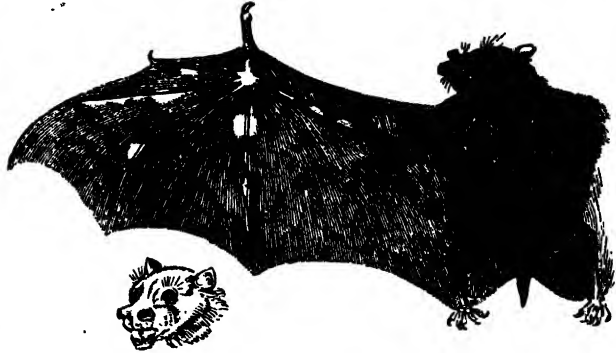


Fig. 9.—*Harpyia Pallasii*.

The Roussettes having been detached, the genuine Bats remain, all of which [excepting *Desmodus*] are insectivorous, and possess three grinders on each side of both jaws, beset with conical points, and preceded by a variable number of false molars. Their index never has a nail, and, a single subgenus excepted, the membrane always extends between their hind-legs. [The greater number have cheek-pouches, and most, if not all, emit a peculiar low clicking note.]

They should be divided into two principal tribes: the first having three bony phalanges to the middle finger of the wing, while the other finger and the index even have only two. To this tribe, which is almost exclusively foreign, belong the following subgenera:—

#### THE MOLOSSINES (*Molossus*, Geoff. *Dysops*†, Illig.)

These have the muzzle simple; the ears broad and short, arising near the angle of the lips, and uniting with each other upon the muzzle; the tragus short, and not enveloped by the conch. Their tail occupies the whole length of the interfemoral membrane, and very often extends beyond it. [Their wings are narrow, and body large and heavy.] It is seldom that they have more than two incisors to each jaw: but, according to M. Temminck, several of them have at first six below, four of which they successively lose.

\* This passage occurs in the Appendix to the original work.—Ed.

† The term *Macroglossus*, however, has unfortunately been pre-occupied in Entomology; for which reason *Kiodotus* (the common name of the species, latinized) may be proposed in its stead. *Harpyia*

is likewise used in Ornithology, where another application must be substituted.—Ed.

‡ This term is more generally accepted.—Ed.



The *Dinae* of M. Savi refers to these *Molossines* with six inferior incisors. There is one of them in Italy (*Dinae cestonii*, Savi).

M. Geoffroy has applied the name *Nyctonomus* to those which have four inferior incisors.

The *Molossines* were at first discovered only in America; but we now know several from both continents. Some of them have the hinder thumb placed farther from the other digits than these are from each other, and capable of separate motion; a character on which, in one species where it is very strongly marked, Dr. Horsfield has established his genus *Cheiromeles* [the ears of which, also, differ in being widely separated].

It is probable that we should also place here the *Thyroptera* of Spix, which appears to have several characters of the *Molossines*, and the thumb of which has a little concave palette peculiar to them (fig. 10, a), by which they are enabled to cling more closely. [Several species of this genus agree in possessing this appendage,

which is proportionally larger in the young.

As a whole, the group of *Molossines* is extremely distinct and insulated, though consisting of a vast number of species, of which about twenty may be considered established; six or seven of these appertain to the eastern hemisphere. The largest and most curious of them is *D. cheiroptus*, Tem. (*Cheiromeles*, Horsf., fig. 11), from Siam, which measures nearly two feet across: it is quite naked, with the exception of an abrupt collar of hairs round the neck.

Several have the upper lip laterally pendent (fig. 10), whence the name *Molossus* or *Mastiff*; and the term *Dysopus* refers to the toes being more or less tufted with hair. The greater number of species are from Brazil and Paraguay.]

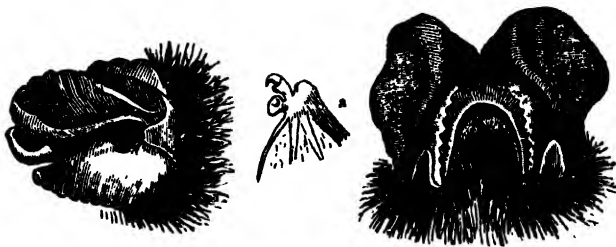


Fig. 10.—Head of *Dysopus tensis*.



Fig. 11.—*Dysopus cheiroptus*.

#### THE NOCTULES (*Noctilio*\*, Lin. Ed. xii.)

Muzzle short, inflated, and split into a double hare-lip, marked with odd-looking warts and grooves; ears separate; four incisors above and two below; tail short, and [possibly in some] free above the interfemoral membrane; [limbs much elongated, the hinder very large and stout, and furnished with strong claws; the volar membranes are attached high upon the back, in some almost meeting dorsally, as in the *Cephalot* and some *Roussettes*.]

The most generally known species is from America (*Vesp. leporinus*, Gm.), of a uniform fulvous. [Others have been found on the same continent: and *Celeno*, Leach, was founded on an imperfect specimen, which is still extant. The *Noctules* are allied to the true Bats (*Vesperugo*); and a group which appears to be somewhat intermediate, but with a more elongated muzzle, is the *Emballonura*, Kuhl (*Proboscidea*, Spix), of which four species have been described from South America, and a fifth from Java. *Pteronotus*, Gray, is probably a *Noctule*, with a longer tail than usual; and *Myotis*, Geoff., and also *Atlo*, Leach, do not seem to differ essentially.]

#### THE PHYLLOSTOMES (*Phyllostoma*, Cuv. and Geoff.)

The regular number of incisors is four to each jaw, but some of the lower ones frequently fall, being forced out by the growth of the canines; [the second false molar is generally elongated]. They are, moreover, distinguished by the membrane, in the form of an upturned leaf, which is placed across the end of the nose. The tragus of their ear (fig. 12) resembles a leaflet, more or less indented. Their tongue, which is very extensible, is terminated by papillæ, which appear to be arranged so as to form

\* The division *Noctilio* was unaccountably ranged by Linnaeus among his *Ghires*, or the *Rodentia* of our author.—Ed.

an organ of suction; and their lips also have tubercles symmetrically arranged. They are American animals, which run along the ground with more facility than the other *Bats*, and have a habit of sucking the blood of animals.

1. Tailless Phyllostomes (*Vampyrus*, Spix).

The Vampyre [of authors] (*Vesp. spectrum*, Lin.)—(fig. 12.) This animal is reddish-brown, and as large as a Magpie. It has been accused of causing the death of men and animals by sucking their blood; but the truth appears to be, that it inflicts only very small wounds, which may sometimes prove dangerous from the effects of the climate. [There are several others, certain of which compose the divisions *Madatus* and *Arctibeus*, Leach, *Lophostoma*, Orb., (which is very like a *Desmodus* externally,) *Diphylla*, Spix, and *Carollia*, Gray,—founded on trivial modifications of the form of the nose-leaf, tragus, and interfemoral membrane.]

2. Phyllostomes with the tail enveloped in the interfemoral membrane.

The Javelin Ph. (*Vesp. hastatus*, Lin.)—The leaf shaped like the head of a javelin, with its edges entire. [Also various others, some of which constitute *Macrophyllum* and *Brachyphylla*, Gray.]

3. Phyllostomes with the tail free above the membrane.

*Ph. crenulatum*, Geof.—The leaf indented on the side.

M. Geoffroy distinguishes from the Phyllostomes those species which have a narrow extensile tongue, furnished with papillæ resembling hairs. He designates them GLOSSOPHAGUES (*Glossophaga*). All the species are likewise from America. [These also have been subdivided, according to the presence or absence of a short tail, and other frivolous characters into *Phyllophora* and *Anoura*, Gray, *Monophyllus*, Leach, and *Glossophaga*, as restricted. Spix applies to one of them (*Gl. amplexicaudata*, *Phyllophora* of Gray) the term *Sanguisuga crudelissima*,—"a very cruel blood-sucker." According to Mr. Bell, the tongue of *Phyllostoma*, has "a number of wart-like elevations, so arranged as to form a complete circular suctorial disc, when they are brought into contact at their sides, which is done by means of a set of muscular fibres, having a tendon attached to each of the warts." The teeth of these animals, however, are decidedly ill-adapted for blood-letting.

THE TRUE VAMPIRES (*Desmodus*, Pr. Max., *Edostoma*, Orb., *Stenoderma*?, Geof.)

This extraordinary genus has two immense, projecting, approximate upper incisors, and similar lancet-shaped superior canines, all of which are excessively sharp-pointed, and arranged to inflict a triple puncture, like that of a Leach; four bilobate inferior incisors, the innermost separated by a wide interval; the lower canines small and not compressed: there are no true molars, but two false ones on the upper jaw, and three on the lower, of a peculiar form, apparently unfitted for mastication (fig. 13). The intestine is shorter than in any other known animal; as blood, which probably constitutes their sole food, is so readily assimilated.\* They have the general characters of the Phyllostomes externally, a small bifid membrane on the nose, no tail or calcaneum, and the interfemoral membrane but little developed. Are also inhabitants of South America.



Fig. 12.—*Vampyrus spectrum*.



Fig. 13.—Teeth of *Desmodus*.

\* In *Peperillo noctula*, the intestine is only twice the length of the body, while in *Pteropus* it is full seven times. In *Desmodus*, it proceeds almost straight to the anus. It would be interesting to know the first or milk teeth of *Desmodus*.

Two or three species are known, of moderate but not large size.\* One was taken in the act of sucking blood from the neck of a Horse, by Mr. Darwin. It is probable that their external similitude to the Phyllostomes has occasioned the latter to be accused of a sanguivorous propensity, for which their structure seems to be at most but partially adapted, while that of the present genus is obviously expressly designed for this mode of life. Compare the figures given of the dentition of the two genera.]

In the second grand tribe of Bats, the index has only one bony phalanx, while all the other fingers have two. This tribe also requires to be divided into several subgenera.

#### THE MEGADERMS (*Megaderma*, Geof.)—

Have the nasal membrane more complicated than in the Phyllostomes; the tragus large and most commonly bifurcated; the conch of the ears very ample, and joined together on the top of the head; the tongue and the lips smooth; interfemoral membrane entire, and there is no tail. They have four incisors below, but none above, and their intermaxillaries remain cartilaginous. [Their wings are remarkably ample, the whole cutaneous system of these animals being excessively developed.]

Four species are known; two from Africa, the others from the Indian archipelago. One of the former (*M. frons*, fig. 14) has the body covered with long hair, of most delicately fine texture; it constitutes the division *Lavia* of Gray.] They are distinguished by the figure of the leaf, like the Phyllostomes.

#### THE RHINOLPHINES (*Rhinolophus*, Geof. and Cuv. [*Noctilio* Bechst.]), vulgarly termed *Horse-shoe Bats*.

These have the nose furnished with very complicated membranes and crests resting on the forehead, and altogether presenting [more or less] the figure of a horse-shoe; their tail is long, and placed in the interfemoral membrane. They have four incisors below, and two small ones above, fixed in a cartilaginous intermaxillary.

Two species are very common in France [and found sparingly and locally in England†].—*Vesp. ferrum-equinum*, Lin., or *Rh. bifer*, Geof., and *Vesp. hipposideros*, Bechstein. They both inhabit quarries [cathedrals, &c.], where they hang solitarily [?] suspended by the feet, and enveloping themselves with their wings, so that no part of their body is visible. [They differ chiefly in size, but in this considerably; the larger measuring 13 inches across, the other 8½ inches.]

More than twenty species are known, all from the eastern hemisphere. They fall under two divisions, of which the extremes are shown in the accompanying representation (fig. 15); but the majority are of intermediate character, like the two which inhabit Europe. Those with membranous crests have the tragus distinct, and sometimes considerably developed; the others have no separated tragus, and compose the divisions *Hipposideros*, Gray, (identical with *Phyllorhina*, Bonap.) and *Asellia*, Gray: *Arctotis* of the same systematist referring to a member of the former sub-group, which is destitute of tail, and almost of interfemoral membrane; characters, however, to which other species approximate. They inhabit the darkest caverns, in vast multitudes, the sexes and young in separate assemblages. Penetrating to more deeply obscure recesses than any of the others, it is probable that their facial appendages are endowed with exquisite sensibility, for the still further extension of that delicacy of the sense of touch, by which others of this family are enabled to guide themselves when deprived of vision: the dryness of those membranes intimates that they are not olfactory. Certain inguinal glands, more or less distinctly developed in these animals, have been erroneously described as mammary teats.

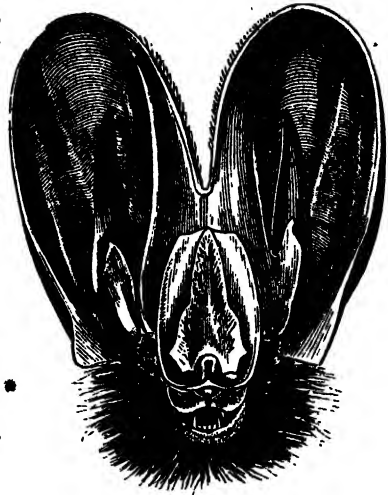


Fig. 14.—*Megaderma frons*.



Fig. 15.—*Rhinolophus nobilis*.

*R. insigne*

\* There is reason to suspect that the genus *Desmodus* is much more extensively represented.—Ed.

† A British locality, where both occur rather numerously, is the well-known cave near Torquay, in Devonshire, called *Ken's Hole*.

### THE NYCTOPHILETS (*Nyctophilus*, Leach)—

Are, according to Temminck, somewhat intermediate to the Rhinolophines and the next genus of Nycterins; approaching the former in the character of their incisors and canines, and the latter in that of their molars: the ears are large and pointed; the tragus lanceolate; nasal follicles distinct; the tail moderately long, and enveloped in the membrane.

*Nyct. Geoffroyi*, Leach, is the only known species, from some part of Oceania. It appears to be allied to the true Bats (*Vesperugo*), and was included in *Barbastellus*, Gray, as originally constituted.

### THE NYCTERINS (*Nycteris*, Cuv. and Geol.)—

Have the forehead furrowed by a longitudinal groove, which is even marked upon the cranium, bordered by a fold of the skin, which partially covers it; nostrils simple; four incisors without intervals above, and six below; ears large and separated; the tail involved in the interfemoral membrane [and terminated by a bifid cartilage (fig. 16, 2).] They are African species [for the most part, but one inhabits Java.

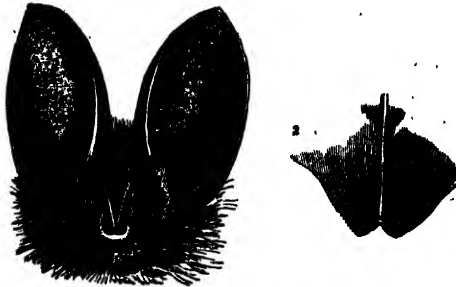


Fig. 16.—Head of *Nycteris javanica*.

These animals are remarkable for a power of inflating the skin, which is only attached to the body in some few places, by an open cellular connexion. There is a small aperture at the bottom of each cheek-pouch, by which this is effected; and the nostrils are so formed as to close when at rest, and to open only at will. By respiring with the mouth closed, the air passes through these apertures along the frontal groove to the upper part of the neck, and thence under the skin of the back, chest, and abdomen, which, by a repetition of the process, can be puffed out like a balloon: the intent remains to be explained.]

### THE RHINOPOMES (*Rhinopoma*, Geol.)—

Have the frontal depression less marked; the nostrils at the end of the muzzle, with a little lamina above, forming a kind of snout; the ears are joined; and the tail [which is very slender] extends far beyond the interfemoral membrane.

[A few species occur on both continents, one of which is figured in the great French work on Egypt, under the name *Taphien Mlet*.]

### THE TAPHIENS (*Taphozous*, Geol.)—

Have also a small rounded indentation on the forehead; but their nostrils have no raised lamina: the head is pyramidal, and there are only two incisors above, very often none, and four trilobate incisors below; their ears are widely separated, and [the tip of] their tail free above the membrane. The males have a transverse cavity under the throat. A little prolongation of the membrane of their wings forms a sort of pouch near the carpus.\*

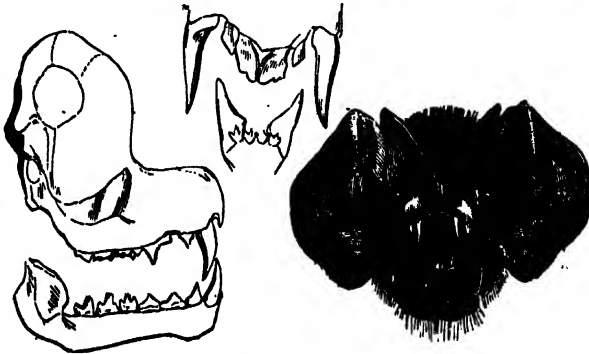


Fig. 17.—*Mermoops Bialavilii*.

One species was discovered in the catacombs of Egypt by M. Geoffroy [and it is probable that the others are peculiar to the old continent, though one (*Vesp. marsupialis*, Muller) is said to be American: *T. rufus*, Harlan (Wils. Am. Orn., vol. vi. pl. 50) is most likely a

\* Hence the name *Mermoops*, applied to this genus by Illiger.

*Vesperugo*.—The Egyptian species is represented to have small eyes; but that figured by Gen. Hardwicke (Lin. Trans., vol. xiv. p. 535) possesses eyes proportionally as large as in a Squirrel, and we have examined skins of another species (chinchilla-grey above, pure white beneath), in which the same character must have been conspicuous.]

#### THE MORMOPES (*Mormoops*, Leach).—

Have four incisors to each jaw, the superior rather large; the inferior trilobate: their skull (fig. 17) is singularly raised like a pyramid above the muzzle; and on each side of the nose is a triangular membrane, which extends to the ear.

The species *M. Blainvillii*, Leach, is from Java. [It has since been received, together with two others of the same form (but considered by Gray as separable), from Jamaica; so that the former locality may be presumed to be wrongly assigned.]

#### THE ORDINARY BATS [to which this term may be restricted] (*Vesperugo*, Cuv. and Geoff.).—

Have no leaf or other distinctive mark on the muzzle, and the ears separated; four incisors above, of which the two middle ones are apart, and six below, sharp-edged, and somewhat notched\*: their tail is comprehended in the membrane.

This subgenus is the most numerous of all, and universally distributed. There are six or seven species in France [more than double that number. Thirteen have now been met with in England, including the Barbastelle and Oreillard. The sexes and young of several congregate separately.†]

\* M. Rousseau, in a memoir on the anatomy of *Vesp. murinus*, states, of the two dentitions of this animal, that the first is developed before birth, the second not till some time afterwards. The fetal teeth, he remarks, are twenty-two in number; namely, four incisors, two canines, and four molars to the upper jaw, and six incisors, two canines, and four molars to the lower one. The permanent teeth, in the adult, are thirty-eight in number; of which twenty-two should replace the fetal or temporary teeth; the sixteen others successively show themselves, later as their position is further backward. The permanent teeth do not wait to appear until their predecessors are shed, whence at a certain epoch forty or fifty teeth, or even more, may be counted in the same individual: this fact we have observed in the instance of the common Fitchet Weasel.—Ed.

† To facilitate the researches of the British naturalist, our known indigenous species may be briefly indicated: it is not unlikely that more remain to be discovered, as but few persons have hitherto bestowed much attention on these lucifugæ animals.

The British species fall under two natural divisions.

In the first, the tragus is more or less rounded at the tip, short, and a little thickened in its substance; there are four pairs of false molars to each jaw. Such are

The Noctule Bat (*V. noctule*).—Of a bright reddish-brown; the membrane dusky. Length of the head and body nearly 3 inches; extent 13 or 14 inches. Ears oval-triangular, shorter than the head; the tragus not one-third the length of the ear, arcuated, and terminated in a broad rounded head; muzzie short, broad, and blunt. This species is not uncommon, and is even numerous in some districts: its flight is lofty, whence designated *altivolans* by White.

Hairy-armed Bat (*V. leisteri*).—The fur long, bright chestnut above, brownish grey beneath; under surface of the flying membrane with a broad band of hair along the fore-arm. Length of the head and body  $2\frac{1}{2}$  inches; extent  $11\frac{1}{2}$  inches. The ears oval-triangular, shorter than the head; tragus barely one-third the length of the ear, terminating in a rounded head. But one specimen is known to have been killed in England.

Particoloured Bat (*V. discolor*).—Fur reddish-brown above, with the tips of the hairs white; beneath, sullied white. Length of the head and body  $3\frac{1}{2}$  inches; extent  $10\frac{1}{2}$  inches. Ears about two-thirds the length of the head, oval, with a projecting lobe on the inner margin; the tragus of nearly equal breadth throughout, rather more than one-third the length of the ear. It inhabits towns, and comes abroad early in the evening. The only native specimen was taken at Plymouth.

Pipistrellus Bat (*V. pipistrellus*, erroneously termed *V. murinus* by British writers till very lately).—This small species is the commonest of any; it is dark reddish-brown, paler beneath. Length to the tail  $1\frac{1}{2}$  inches; extent  $8\frac{1}{2}$  inches. Ears two-thirds the length of the head, oval-triangular, notched on the outer margin; tragus nearly half as long as the ear, almost straight, thickened, obtuse, and rounded at the apex. It runs with celerity, carrying its head near the ground, from which it rises with ease; and is active during the greater part of the year. The Pygmy Bat (*V. pygmaeus*, Leach), is evidently a young animal, and probably of this species.

The next has only two pairs of superior false molars.

The Serotine Bat (*V. serotinus*).—Fur chestnut-brown above, yellowish-grey beneath. Length of the head and body  $2\frac{1}{2}$  inches; ex-

tent  $13\frac{1}{2}$  inches. The ears oval triangular; shorter than the head; tragus semicordate, little more than one-third the length of the ear. The Serotine frequents uninhabited houses, the roofs of churches, &c. and sometimes hollow trees; flies steadily and rather slow, and is occasionally taken near London.

In the second group, the tragus is relatively longer, thin, narrow, and more or less pointed; and there are six pairs of false molars to each jaw.

Moose-coloured Bat (*V. murinus*).—The fur reddish-brown above, dull white beneath. Length of the head and body  $3\frac{1}{2}$  inches; spread of wing 15 inches. Ears oval, broad at the base, becoming narrower towards the apex, as long as the head; tragus falciform, the inner margin straight, not quite half the length of the ear. This Bat is very common in France and Germany, but only one instance has been recorded of its occurrence in Britain.

Bechstein's Bat (*V. Bechsteini*).—Fur reddish-grey above, greyish-white beneath. Dimensions, to the insertion of the tail,  $2\frac{1}{2}$  inches; 11 inches across. Ears oval, rather longer than the head; tragus narrow, falciform, not half the length of the ear. The thumb longer than in the others. A woodland species, found occasionally in the New Forest, Hants.

Fringe-tailed Bat (*V. Nattereri*).—Fur brown above, whitish beneath. Length, to the tail, nearly 2 inches; extent 11 inches. Ears oblong-oval, about as long as the head; tragus narrow-lanceolate, nearly two-thirds the length of the ear; intermembral membrane with the margin crenate and stiffly ciliated, from the end of the spur or calcaneum to the tail. Has been met with in several parts of the country.

Notch-eared Bat (*V. emarginatus*, Geoff., not of Jenyns).—The fur reddish-grey above, ash-coloured beneath. Length of the head and body two inches; extent 9 inches. The ears oblong, as long as the head, with a notch and a small lobe on the outer margin; tragus awl-shaped, a little curved outward, more than half the length of the ear. One was killed near Dover.

Daubenton's Bat (*V. Daubentonii*,—*emarginatus* of Jenyns).—Fur soft, plentiful, brownish-black at the base; the surface greyish-red above, ash-grey beneath. Length of the head and body 2 inches; extent 9 inches. The ears oval, three-fourths the length of the head, very slightly notched on the outer margin, with a fold on the inner margin at the base; tragus narrow-lanceolate, rather obtuse, bending a little inward, half the length of the ear; tail longer than the body. Has been taken in several localities, and flies rapidly near the ground, or over stagnant water.

Whiskered Bat (*V. mystacinus*).—Fur blackish-chestnut above, dusky beneath; the upper lip furnished with a moustache of long fine hair. Length of the head and body  $1\frac{1}{2}$  inch; extent  $8\frac{1}{2}$  inches. Ears oblong, bending outward, shorter than the head, notched on the outer margin; the tragus half the length of the ear, lanceolate, a little expanded at the outer margin near the base. Has also occurred in different parts of the country.

The above characters are chiefly compiled from Bell's British Quadrupeds, where figures and minute descriptions are given of each of them, together with full-sized representations of their heads. It may be remarked that only the last five are retained in *Vesperugo* by Mr. Gray, the others being included in his *Scotophilus*.—Ed.

M. Geoffroy also separates from the Bats

THE OREILLARDS (*Plecotus*).—

Which have the ears longer than the head, and joined above the cranium, as in the *Megaderma*, *Rhinopomes*, &c. Their tragus is large and lanceolate, and there is an operculum to their auditory orifice.



Fig. 18.—Ears of *Plecotus auritus*.

The common species (*Vesp. auritus*, Lin.) is still more abundant in France than any of the Bats [and is equally plentiful in England], inhabiting houses, kitchens, &c. Its ears (fig. 18) are nearly as long as its body [more than double the length of the head; yet, when reposing (as shown in fig. 19), they are folded so as to be out of sight. Its peculiar shuffling gait, with the head raised, is different from that of the Bats with short ears; and it may be tamed to hover around with familiarity, and alight upon the hand for insect food. The *Pl. brevimanus*, Jenyns, is merely the young; but there are several exotic species.] We have also another, discovered by Daubenton, with much shorter ears, [now forming the equivalent division



Fig. 19.—*Plecotus auritus*.

BARBASTELLE (*Barbastellus*, Gray).—

The ears of which are moderate, united at base; and there is a hollowed naked space on the upper surface of the muzzle, in which the nostrils are situated; but one pair of false molars to each jaw.

*B. Daubentonii*, Bell, (fig. 20,) is the only ascertained species. It is of rare occurrence in Britain, and measures 10½ inches in extent of wing.]

Finally, *Nycticeus*\*, Ra fin., [*Scotophilus*, Leach, *Pipistrellus*, Bonap.], with

ears of medium size, and the simple muzzle of the Bats, has only two incisors to the upper jaw [which are widely separated, and close to the canines.] It does not otherwise differ from *Vespertilio*.



Fig. 20.—*Barbastellus* Daubentonii.

The known species are from North America, [but others have since been discovered in the ancient continent, as *N. Heathii*, Horst., from India, and another from Java. Mr. Gray, indeed, includes most of the European Bats in his *Scotophilus*; but Temminck, who rejects *Plecotus* even, suggests, and I think with reason, that the present also is a superfluous division, based on insufficient characters. The Oreillards and Barbastelles are subordinate to *Vespertilio*, also *Furia*, F. Cuv., (*Furipterus*, Bonap.) which has the tail partly cartilaginous, *Natalus*, Gray, wherein the heel-bone extends the whole length of the interfemoral membrane; *Romicus*, Gray, and *Miniopterus*, Bonap. *Atalapha*, Rafin., is said to have no incisors, *Hyperodon*, Rafin., to have incisors (of the usual number, six) in the lower jaw only; *Lasturus* has been applied to a small group with the interfemoral membrane hairy; and, lastly, *Pachyotus* and *Nyctalus*, Bowditch, are divisions of no value whatever. It is to be regretted that naturalists cannot occupy their time more profitably than in coining supernumerary names.

\* Sometimes written *Nycticejus*.—En.

Many of the foregoing animals fly with their young involved in the interfemoral membrane. The extremity of the tail in some is slightly prehensile.

It is remarkable here, that the order *Primates*, indicated at p. 43, resolves into two primary divisions, of which the second is constituted by the *Cheiroptera*, as opposed to the remainder, or the *Bimana* and *Quadrumana* of Cuvier. We regard the *Cheiroptera* as divisible into two groups only of the value of families, namely, *Pteropidae*, comprising the frugivorous genera, and *Vespertilionidae*, comprehending all the remainder, which may probably be reduced to seven or eight primary divisions. The remains of insectivorous *Cheiroptera* have been detected in the European tertiary deposits.]\*

#### THE COLUGOS (*Galeoptihacus*, Pallas)—

Differ generically from the Bats in having their fingers, which are armed with trenchant nails, no longer than the toes, so that the membrane which occupies their intervals, and extends to the sides of the tail, can only officiate as a parachute. Their canines are dentelated, and as short as the molars. They have two [four] dentelated incisors above, very widely apart; six below†, split into narrow

strips like a comb, a structure altogether peculiar. These animals live on the trees in the Indian archipelago, and pursue insects, and perhaps birds; to judge from the detrition which their teeth experience with age, they would appear to subsist also upon fruits. They have a large cœcum.

[This remarkable genus accords chiefly with the Bats in the adaptive structure of its hind extremities, and in the tail being completely attached to interfemoral membrane: the molars, also, are sharply tuberculated, implying an insectivorous regimen, at least in part; but this character is common to several *Strepsirrhini*: there is also a tendency to an opposable power in both the fore and hind thumbs. The general anatomy agrees very closely with that of the Lemurs; one marked feature in which it differs from the Bats is, the presence of a large cœcum, as intimated by Cuvier. The orbits of the skull, though raised, are much less approximated than in the Lemurs, and incomplete; in which respect this genus chiefly deviates from the type of the *Quadrumana*. A parachute membrane occurs, likewise, among the Squirrels and Phalangers, only not extending to the tail, as in the present instance; this, therefore, is merely an adaptive character of minor importance. Linnæus designated the only species he knew *Lemur volans*.

"Two species," remarks Temminck, "are strongly characterized by their osteology;" which may be presumed to be those provisionally named by Waterhouse

*G. Temminckii*, and *G. philippinensis*, both of which are extremely variable in colour. The former is more extensively diffused, and superior in its linear dimensions, but with smaller hands and ears; its teeth are separated by intervals, and the parietal ridges of the cranium are widely apart: in the latter there are no interspaces between the teeth, which are much stouter and broader; the jaw is accordingly much stronger, and to impart additional vigour to the muscles which operate upon it, the parietal ridges, to which they are attached, almost meet on the occiput. They inhabit lofty trees in dark woods; to which they cling with all four extremities, and traverse easily by means of their strong and extremely compressed, very hitching claws; they also leap and float a distance of a hundred yards in an inclined plane, supported by the membrane. They are very inoffensive animals, subsisting in part on the leaves of the nanka, or jack-fruit; and when captured, do not attempt to bite, as has often

\* Our plan only permitting us to class those animals the characters of which we have personally ascertained, or from very complete descriptions and figures, we have been obliged to omit several genera of MM. Rafinesque, Leach, &c.; and may here observe that there is no group of animals which stands more in need of revision than

that of the Bats—a revision from Nature, and not from compilation. [Their mutual affinities particularly require elucidation.]

† Analogy with the Lemurs intimates that the exterior of these represent the canines.—Ed.



Fig. 21.—*Galeoptihacus* Temminckii.



been remarked on cutting down the tree to which one was clinging, and seizing it before it could extricate itself from the branches. They produce generally two young at a birth; and their cry resembles the low cackle of a Goose.]

All the other *Carnaria* have the mammae situated on the belly.

## THE SECOND FAMILY OF CARNARIA,—

### INSECTIVORA,—

Possess, like the *Cheiroptera*, grinders beset with conical points, and generally lead a nocturnal or subterraneous life: they subsist principally on insects, and in cold countries most of them pass the winter in a torpid state. They have no lateral membranes, as in the *Cheiroptera*; but the clavicles are never absent: their feet are short, and their movements feeble\*; the mammae are placed under the abdomen, and the penis in a sheath. None of them have a cæcum, and in running they all place the entire sole of the foot upon the ground.

They differ in the relative proportions and position of their incisors and canines.

Some have long incisors in front, followed by other incisors [along the sides of their narrow jaws], and canines, all shorter even than the molars; a kind of dentition, of which the *Malpaga*, among the *Quadrumana*, have already afforded an example, and which somewhat approximates these animals to the Rodents: others have large separated canines, between which are placed small incisors, being the ordinary disposition of these teeth both in the *Quadrumana* and *Carnaria*; and these two systems of dental arrangement occur in genera otherwise very similar in the character of their teguments, in the form of their limbs, and mode of life.

[It is in this group that we are led to identify the canine tooth as simply the first of the false molars, which in some has two fangs; and, as in the Lemurs, to perceive that the second in the lower jaw is in some more analogous in size and character to an ordinary canine, than that which follows the incisors. The incisor teeth are never more than six in number, which is the maximum throughout *placental* Mammalia (as opposed to *marsupial*); and, in several instances, one or two pairs are deficient†: the canines, with the succeeding false molars, are extremely variable‡; but there are ordinarily three tuberculated molars posterior to the representative of the carnivorous or cutting grinder of the true *Carnivora*. The snout in the *Insectivora* is generally elongated.]

### THE URCHINS, OR HEDGEHOGS (*Erinaceus*, Lin.)—

Have the body covered with prickles instead of hairs. The skin of the back is furnished with such muscles that the animal, by inclining its head and feet towards the belly, is enabled to inclose itself as in a purse, presenting only its spines towards an enemy. Their tail is very short, and their feet have each five toes. They possess on each jaw six incisors, of which the middle are the longest; and on either side three false molars, three bristled true molars, and a small tuberculous tooth.

The European Urchin (*E. Europæus*, Lin.).—A well known species, common in the woods and hedges. It subsists chiefly on insects, but also feeds partly upon fruit, by which at a certain age its teeth become worn: passes the winter in its burrow, whence it issues in the spring with an amplitude and complication of its *vesicula seminales* that is almost incredible. [It produces a variable number of young, sometimes six or seven, which are born with their eyes closed, and, what is remarkable, their ears also: their prickles are then thin, and few in number, white, and at first flexile and disposed backward; but they soon harden on exposure. The adults remain concealed till the evening, when they run about in search of prey, with an omnivorous appetite; they devour Toads, and have been known to destroy leverets.] Pallas has noticed as an interesting fact, that the Urchin eats hundreds of *Cantharides* without experiencing any ill effect, whereas a single one produces horrible agony in a Dog or Cat.

[Ten other species are now known, distributed over Asia and Africa, but not Madagascar. Some are of small size, and others have the ears considerably enlarged.

\* In *Macrocheilids*, the hind feet are lengthened, and announce agility; while the *Banzirings* are said to be as lively as a Squirrel.—En.

† The forked incisors of the Shrews appear each to represent two teeth; and the analogues of the inferior central incisors, wanting in

this genus, appear, in *Solenodon* and *Myogales*, of small size, between the representatives of the long dentulated incisors of *Sorex*.

‡ It should be remarked that a single tooth with two fangs is often represented by two separate teeth, each with one fang.



THE SOKINAH (*Echinops*, Martin).—

Is a Madagascar animal, which differs chiefly from the Urchins in its dentition, having but four upper incisors, of which the medial are large, and placed before the others; the superior canines (or what may be designated as such) are tuberculated behind; there are five molars in all to each side of the upper jaw, longitudinally very short, but broad, a groove passing continuously along their crowns: two small lower canines, three inferior false molars inclining forward, and four true molars obtusely tuberculated.

*E. Telfairi*, Mart., is the only ascertained species; and the form may be regarded as subordinate to *Erinaceus*.]

THE TENRECS (*Centenes*, Illiger).—

Have the body covered with spines, like the Urchins [but more slender and bristle-like]; they do not, however, possess the faculty of rolling themselves so completely into a ball: they have no tail; their muzzle is very pointed, and their teeth are very different. On each jaw are from four to six incisors, and two large canines: next follow one or two small teeth, and four triangular molars with sharply tuberculated crowns. They are natives of Madagascar, one species having been naturalized in the Mauritius: are also nocturnal animals, which pass three months of the year in a state of lethargy, although inhabiting the torrid zone. Brugiere even asserts that it is during the greatest heats that they become torpid.

[Three if not four species have been ascertained; one of which, the Tendrac of Buffon (*Erinaceus setosus*, Linn.), with six incisors to each jaw, composes the *Erethicus* of Is. Geoffroy.

The foregoing genera have little or no tail, whereas the following have very long tails.]

THE GYMNURES (*Gymnura*, Vig. and Horaf. [*Echinosorex*, Blain.])—

"Appear to approach the Banxring in dentition, and the Shrews by the pointed muzzle and scaly tail. There are five ungulculated toes to each foot, and tolerably stiff [almost spinous] bristles growing among woolly hair, [resembling the close fur of the Shrews.] It can only be properly classed when its anatomy is known."\* [The general aspect is that of a Tenrec, with a long, naked, and scaly tail. There are six incisors to each jaw, the medial above widely separated, large, and resembling canines; the others lateral, and successively smaller: those below are separated into two pairs, the middle ones being somewhat apart, and one smaller on each side. The canines are moderately large, and somewhat curved, those of the upper jaw having two fangs: next follow, on each jaw, two pairs of small false molars, succeeded by one larger above, and two below; and the true molars are four in number above and three below, square, and tuberculated as in the Urchin.

The only known species (*G. Rafflesi*) inhabits Sumatra, and is larger than the Urchin of Europe.

The various preceding genera have small but not minute eyes.

THE MACROSCELLES (*Macroscelides*, Smith; *Erinomys*, Blain.; *Rhynomys*, Lichst.).—

Compose a well-marked genus, somewhat resembling the Shrews, but with large eyes and more elongated hind-feet: their fur is long and soft, and of very fine texture. They have six (lateral) incisors to each jaw, minute canines, and on either side five sharply tuberculated molars. Their habits are diurnal, and they retreat into burrows or beneath stones on apprehension of danger.

Eight species are known, all from South Africa except one, which inhabits Algiers. They are called *Elephant Mice* in the Cape Colony.]

THE BANXRINGS (*Tupaia*, Raff.; *Cladobates*, Fr. Cuv. [*Ghisorax*, Diard.; *Hylogale*, Tem.])—

A genus lately characterized, from the Indian Archipelago, the teeth of which bear some resemblance to those of the Urchins, only that their middle superior incisors are proportionally shorter, and there are four to the lower jaw, more elongated, [and projecting forwards as in the Lemurs]; they also [do not] want the tuberculous tooth behind. These animals are covered with hair [soft and glistening, but not fine in texture], and have a long bushy tail; and, contrary to the habits of other *Insectivora*, they ascend trees with the agility of a Squirrel, but their pointed muzzle renders them easily distin-

guishable, even at a distance. [The general form is not unlike that of the Marsupial genus *Myrmecobius*: and the bony orbits of the cranium are sometimes complete.

Three species are known, the *T. tana*, *sumatrana*, and *ferruginea*, all of which are well characterized by differences in the conformation of the cranium, in addition to external distinctions: they inhabit trees, and are lively and active animals.\*

All the remaining genera have minute eyes.]

#### THE SHREWS (*Sorex*, Lin.)—

Are generally small, and covered with [soft] hair. Under this, on each flank, there is a band of stiff, closely-set bristles, from between which, during the rutting season, exudes an odorous fluid, the product of a peculiar gland. Their two middle superior incisors are hooked, and dentated at the base; the lower ones slanting and elongated: five small teeth follow on each side the first, and only two the second. There are besides, on each jaw, three bristled molars, and finally on the upper one a small tuberculous tooth. These animals retire to holes they burrow in the ground, which they scarcely leave till towards the evening, and subsist on worms and insects.

[We have observed them to be much about during the day, under shelter of close herbage, where their sibilant and insect-like cry notifies their presence, and have occasionally seen them venture forth from cover when all was quiet.† M. Duvernoy discovered that their incisors occupy, from the first, the position they maintain in after-life, but are enveloped for a while by the *peristœum* or investing membrane of the bone to which they are attached, through which the larger protrude some time before the others: he accordingly infers that these animals have no milk-teeth. The same naturalist divides this genus into

1. *Sorex*, Duv. (*Oroidura*, Wagl.; including *Myosorex*, Gray); wherein the edge of the long inferior incisors is un serrated; that of the upper notched, or with the spur appearing as a point behind; the small lateral teeth which follow are three or four in number, and diminish rapidly in size from the first to the last; none of the teeth being coloured. The ears are conspicuously developed, and the tail has always longer and coarser hairs mingled with the ordinary short ones. This group, which is very distinct, comprises all the numerous extra-European species, together with three (*S. araneus*, Geoff., *S. Etruscus*, Savi, and *S. leucodon*, Herm.) which are met with on this continent. None occur in the British islands. One of the most remarkable is *S. giganteus*, Is. Geoff., from India, which approaches in size to the Black Rat, and has a follicle on each side, producing a pungent musky secretion.

The remainder have the ears buried in the fur, and consequently inconspicuous.

2. *Amphisorax*, Duv. (*Corstra*, Gray).—Incisors of the lower jaw with the edge dentelated; those of the upper forked, the spur behind prolonged to a level with the point in front: the lateral small teeth which follow five in number, and diminishing gradually in size: all the teeth more or less coloured at the tips. The British species have till very recently been confounded together under the name *araneus*, which pertains to a continental member of the preceding division.‡

3. *Hydrosorex*, Duv. (*Amphisorax* and *Crossopus*, Gray).—The inferior incisors with an entire edge; the upper notched, or with a spur appearing as a point behind: the lateral teeth which follow in the upper jaw four in number; the first two equal, the third somewhat smaller, and the fourth rudimentary: tips of all the teeth a little coloured. This division, which comprises the aquatic species, is less distinct from the second than both are from the first. *Crossopus* of Gray is indeed stated to have the lower incisors dentelated. The British species require further elucidation.§

The Shrews compose an exceedingly numerous genus, the first section of which appears to be almost generally diffused. They renew their covering both in spring and autumn, acquiring a longer and less glossy winter coat; and the mode of effecting this is rather peculiar, the change commencing at the head and proceeding backward, preserving a distinct cross line of demarcation throughout its progress. These animals are often found dead on foot-paths, and dry ditches, on spots devoid of herbage, the cause of which remains to be explained.

\* It is remarkable that the Squirrels of the same region have very similar fur, both in colour and texture.

† The common Shrike (*Lanius collurio*) preys much upon our native shrews.—En.

‡ Mr. Jenyns distinguishes them as follows: all are of a reddish-brown colour.

The Common Shrew (*A. rusticus*, Jenyns).—Snout and feet slender; tail moderately stout, nearly cylindrical, not attenuated at the tip, well clothed with hairs, which are very divergent in the young state, and never closely appressed. It appears principally to frequent dry situations—gardens, hedge-banks, &c.

Irish Shrew (*A. hibernicus*, Jenyns).—Admitted as a species doubtfully, until more specimens have been examined. It is allied to but apparently smaller than the last, with the colours more uniform, and tail shorter and more slender.

Square-tailed Shrew (*A. tetragonurus*, Herm.).—The snout broad, compared with that of the common Shrew; feet, the fore especially, much larger; the tail slender, more quadrangular at all ages, and slightly attenuated at the tip; clothed with closely appressed hairs in the young state, in age nearly naked; upper parts very deep reddish brown; below, dirty yellowish-gray. This species is more attached to

marshy districts, though not confined to them.

Chestnut Shrew (*A. castaneus*, Jenyns).—Snout and feet much as in the last species, but the former rather more attenuated; tail moderately short, nearly round, well clothed with hairs, which form at the extremity a long pencil: upper parts, as well as the snout, feet, and tail, bright chestnut; under parts ash-grey. The cranium is broader posteriorly and rather more elevated in the crown than in *A. tetragonurus*. It inhabits the same marshy districts.

§ Mr. Jenyns distinguishes the

*H. fodiens*, Gm.—Of a deep brownish-black above, nearly white beneath; the two colours distinctly separated on the sides: feet and tail ciliated with white hairs. It inhabits marshes and banks in ditches, but is occasionally met with at a distance from water. It often seeks its prey at the bottom of pools under water, thus approximating in habit to the Desman.

*S. ciliatus*, Sowerby (reviser of Yarrall, and doubtfully of Geoffroy).—Black above; grayish-black beneath; throat yellowish-ash colour; feet and tail strongly ciliated with grayish hairs. Is found in the same situations as the preceding.

There is reason to suspect others, one or more marked with rufous on the under parts having been indicated by observers.—En.

THE SOLENODON (*Solenodon*, Brandt).—

Resembles a gigantic Shrew, but with coarse fur, and proportionally much longer whiskers: the tail is long, naked, and scaly, and the claws considerably more developed. There are six incisors to each jaw, the first pair above, and the second pair below, very large, and resembling canines; two superior false molars, and three inferior, on each side; then five true molars above, and four below, subquadrate, and broad or transverse.

The species, *S. paradoxus*, Brandt, inhabits Hayti, and is larger than the Brown Rat.]

THE DESMANS (*Mygale*\*, Cuv.).—

Differ from the Shrews by having [like the *Solenodon*] two very small teeth placed between the two large inferior incisors, and in their upper incisors, which are flattened and triangular. Behind these incisors are six or seven small teeth, and four bristled molars. Their muzzle is elongated into a small, very flexible proboscis, which is constantly in motion. Their long tail, scaly and flattened at the sides, and their feet with five toes all connected by membrane, proclaim them to be aquatic animals. Their eyes are very small, [the fur long, straight, and divergent,] and they have no external ears.

The Russian Desman (*Sorex moschatus*, Lin.).—Nearly equal in size to the common Urchin; blackish above, inclining to white beneath; the tail one fourth shorter than the body. It is very common along the rivers and lakes of Southern Russia, where it feeds on worms, the larvæ of insects, and particularly on Leeches, which it easily withdraws from the mud by means of its flexible proboscis. Its burrow, excavated in a bank, commences under water, and ascends to above the level of the highest floods. This animal never comes voluntarily on shore, but is taken very often in the nets of the fishermen. Its musky odour arises from a kind of pomatum secreted in small follicles under the tail, and is even communicated to the flesh of Pike which devour the Desman.

There is found in the streamlets of the Pyrenees a smaller species of this genus, which has the tail longer than its body (*Myg. pyrenaica*, H.). [This constitutes the division *Mygalina* of Isidore Geoffroy.

The rest of the *Insectivora* have amazingly powerful fore-feet, designed for tearing open the ground, rather than for burrowing by merely scratching away the mould, as in the preceding genera.]

THE CHRYSOCHLORES (*Chrysochloris*, Lacepede).—

Like the preceding genus, possess two incisors above and four below; but their grinders are elevated, distinct, and nearly all in the form of triangular prisms: the muzzle is short, broad, and recurved; and their fore-feet have only three nails, of which the exterior is very large, much arcuated, and pointed, forming a powerful instrument for digging and burrowing into the soil; the others successively decrease in size. Their hind limbs have five toes of the ordinary dimensions. They are subterraneous animals, whose mode of life is similar to that of the Moles. To enable them to dig the better, their fore-arm is supported by a third bone placed under the cubitus.

The Cape Chrysochlore (*Talpa asiatica*, Lin. [now better known as *C. capensis*, Desm.]).—Rather smaller than our Moles, without apparent tail. It is the only known quadruped which presents any appearance of those splendid metallic reflections which adorn so many birds, fishes, and insects. Its fur is of a green, changing to copper or bronze: the ears have no conch, and the eyes are not perceptible.† It inhabits Africa, and not Siberia, as falsely reported. [There are three others, *C. hottentota*, *Damarensis*, and *villosa*, all from the same general locality.]

THE MOLES (*Talpa*, Lin.).—

Are well known for their subterraneous life, and for their structure eminently qualified in adaptation to it. A very short arm, attached to a large shoulder-blade, supported by a stout clavicle, and provided with enormous muscles, sustains an extremely large hand, the palm of which is always directed either outwards or backwards: the lower edge of this hand is trenchant, and the fingers scarcely perceptible, but the nails which terminate them are long, flat, strong, and sharp. Such is the instrument which the Mole employs to tear open the ground, and throw back the mould behind it. Its sternum possesses, in common with that of Birds and Bats, a ridge which allows the pectoral muscles to attain the magnitude requisite for the performance of their functions. To pierce and raise up the ground, it makes

\* This name being preoccupied by a genus of Spiders, Fischer has altered it to *Mygale*.—Ed.

† The Red Mole of America, Seba I. pl. xxxii. fig. 1, (*Talpa rubra*, Lin.), is most probably a Cape Chrysochlore, figured from a dried specimen, for then the fur appears purple. [It is more likely the *Scalops*

*canadensis*.] But the *Tween* of Fernandez, regarded as one of its synonymes, appears rather, to judge from its two long teeth to each jaw, and vegetable regimen, to be some subterraneous rodent, perhaps a *Diplostoma*.

use of its long, pointed head, the extremity of its muzzle being provided with a peculiar little bone, and the cervical muscles being extremely powerful. There is even an additional bone in the cervical ligament. The hinder part of the body is feeble, and the animal above ground advances as awkwardly as it does rapidly below the surface. Its sense of hearing is extremely acute, and the tympanum very large, although there is no external ear; but the eyes are so small, and so hidden beneath the hair, that their existence even was denied for a long while. [They have been ascertained, however, to be tolerably sharp-sighted.] The genital organs have this peculiarity, that the bones of the pubis do not become joined; by reason of which, notwithstanding the narrowness of the pelvis, they are enabled to produce tolerably large young ones: the urethra of the female passes through the clitoris: she has six teats. The jaws are feeble, and the food consists of insects, worms, and some tender roots, [chiefly, however, worms, though even small birds are sometimes sacrificed to their voracity, when they can dart upon them from the entrance of their runs]. There are six incisors above and eight below.\* The canines have two roots, in which respect they partake of the nature of false molars†: behind them are four false molars above, and three below; and finally, three bristled molars. [The fur is set vertically in the skin, whence it has no grain or particular direction.]

Our common European Mole (*T. Europea*, Lin.).—Entirely black, but often varying to white, fulvous, or pied. [A most remarkable animal, not only for the ardour of its passions, appetites, and emotions, but for the curious instincts with which it is endowed, more particularly with regard to the complicated regularity of its subterranean dwelling and galleries.] According to M. Harlan, this species likewise exists in North America [or, at any rate, there is a species stated to be from that continent most closely allied to it, of which the Zoological Society of London possess specimens.]

M. Savi has found a Mole in the Apennines said to be quite blind, although otherwise similar to the common one (the *T. caeca*, Sav.): it is not, however, perfectly blind, for the eyelids have an opening, though smaller than in the common Mole. The existence of the optic nerve in this last species has been denied: I think I can demonstrate it throughout its course. [Two other species are known, *T. japonica* and *T. moogura*.]

#### THE CONDYLURES (*Condylura*, Illig.).—

Seem to combine the two kinds of dentition of the *Insectivora*: their upper jaw has two large triangular incisors, two others which are extremely small and slender, and upon each side a strong canine; the lower jaw has four incisors slanting forward, and a pointed canine of small size. Their superior false molars are triangular, and separated; the lower dentelated and trenchant. In their feet and whole exterior, the animals of this genus resemble the Moles, but have a longer tail, and, what very readily distinguishes them, their nostrils are encircled with small moveable cartilaginous points, which, when they separate, radiate like a star.

[Three or four species are now known, all from North America. Among them is] *Sorex cristatus*, Lin.

#### THE SHREW-MOLES (*Scalops*, Cuv.).—

Have teeth rather similar to those of the Desmans, except that their small or false molars are less numerous; the muzzle is simply pointed, as in the Shrews; and their hands are widened, armed with strong nails, and in short adapted for digging into the ground precisely as in the Moles, which they entirely resemble in their mode of life. Their eyes are equally small, and their ears concealed in the same manner.

*Sorex aquaticus*, Lin.—Appears to inhabit a very great part of North America, along the rivers: externally, it so nearly resembles the European Mole as to be readily mistaken for it. [Three other species, from the same general locality, have been recently discovered.

The INSECTIVORA, according to the views of De Blainville, should constitute an entirely distinct order, intermediate to the *Cheiroptera* and *Edentata*.

They present an almost unbroken series of successively distinct divisions, more or less allied together. The most definite super-generic section is that composed of the four genera last in order, or the various animals analogous to the European Mole. At the other end of the series, the spinous genera, at first sight, appear equally separated; but they certainly grade through *Centetes* and then *Gymnura* to the Shrews, which are again related to the *Talpidae*; if, indeed, the line of separation should not be drawn between *Centetes*, and *Erinaceus* and *Echinops*: the

\* Were this truly the case, it would be an anomaly throughout placental Mammalia: but as the lower canines, as thus assigned, close within the upper, we are led to identify the exterior pair of seeming

incisors as the real canines.—Ed.

† There is no essential difference between canines and false molars. See p. 77.—Ed.

different generic groups, however, maintain their integrity. *Macroscelides* and *Tupaia* are the least conformable with the others; but neither are these much removed in their more essential characters. As a whole, they compose a very natural and appreciable division, and our author assigns them a rank equivalent to the CHEIROPTERA on the one hand, and to the CARNIVORA, comprising his *Plantigrada*, *Digitigrada*, and *Amphibia*, on the other.

Remains of three species of *Sorex*, one of *Talpa*, and one of *Brinaceus*, have been found in the European Tertiary deposits, apparently referable to species still in existence. The present range of the division does not extend to South America\* nor Australia, where, however, it appears to be adequately represented by the numerous small *Marsupiatæ*, peculiar to those regions; a curious fact, first noticed by Waterhouse, and since by De Blainville.]

### THE THIRD FAMILY OF CARNARIA.

#### CARNIVORA.

Although the designation *carnivorous* is applicable to all unguiculated Mammalia, except the *Quadrumana*, which have three sorts of teeth, inasmuch as they all subsist more or less on animal matter, there are nevertheless many, more especially of the two preceding families, which are reduced by the feebleness and the conical tubercles of their grinders to prey almost entirely on insects. In the present family, the sanguinary appetite is combined with the force necessary for its gratification. There are always four stout and long separated canines, between which are six incisors to each jaw, of which the second inferior are inserted a little more inward than the rest. The molars are either wholly cutting, or have some blunted tuberculous parts, but they are never studded with sharp conical projections.

These animals are the more exclusively carnivorous, in proportion as their teeth are more completely trenchant or cutting, so that the degree of admixture of their regimen may be almost calculated from the extent of the tuberculous surface of their teeth, as compared with the cutting portion. The Bears, which can live altogether on vegetables, have nearly all their teeth tuberculated.

The anterior molars are the most trenchant; next follows a molar, larger than the others, which has usually a tuberculous projection, differing in size; and then follow one or two smaller teeth, that are entirely flat. It is with these small hindward teeth that the Dog chews the herbage that he sometimes swallows. We will call, with M. F. Cuvier, this large upper molar, and its corresponding one below, *carnivorous teeth*; the anterior pointed ones, *false molars*, and the posterior blunt ones, *tuberculous molars*.

It is easy to conceive that the genera which have fewer false molars, and of which the jaws are shorter, are consequently better adapted for biting.

Upon these differences the genera can be most surely established.

The consideration of the hind-foot, however, must also be attended to.

Several genera, like those of the two preceding families, in walking, place the whole sole of the foot on the ground, a circumstance [generally] indicated by the absence of hair on all that part.†

Others, and by far the greater number, rest on only the ends of the toes, elevating the tarse. Their gait is more rapid, and to this primary difference are added many others of habit, and even of internal conformation. In both, the clavicle is a mere bony rudiment suspended in the muscles.

#### THE PLANTIGRADA

Constitute this first tribe, which walk on the whole sole of the foot, a circumstance which gives them greater facility of standing upright upon their hind-feet. They partake of the slowness

\* *Sorex tristatus* of some of the old authors is a true *Didelphis*.

with hair: the same is observable in some Martens; while others of this genus have the sole altogether naked.—Es.

† In the Polar Bear, and Panda, the sole is completely covered |

and nocturnal life of the *Insectivora*, and, like them, have no cæcum: most of those which inhabit cold countries pass the winter in a state of lethargy. All have five toes to each foot.

#### THE BEARS (*Ursus*, Lin.)—

Possess three large molars on each side of both jaws\*, altogether tuberculous, and of which the posterior above are the most extended. These are preceded by a tooth a little more trenchant, which is the carnivorous tooth of this genus†, and by a variable number of very small false molars, which sometimes fall at an early age. This system of dentition, almost frugivorous, explains why, notwithstanding their great strength, the animals of this genus devour flesh only from necessity.

They are large stout-bodied animals, with thick limbs, and tail extremely short: the cartilage of their nose is elongated and moveable. They excavate dens and construct huts [?], where they pass the winter in a state of somnolency more or less profound, and without taking food. It is in these retreats that the female brings forth.

The species are not easily distinguished by obvious characters.

The Brown Bear (*U. arctos*, Lin.) of Europe, has the forehead convex: fur, brown, more or less woolly when young, becoming smoother with age. It varies, however, considerably in colour, and also in the relative proportion of parts: the young have generally a pale collar, which in some is permanent. This animal inhabits the high mountains and extensive forests of Europe, together with a great part of Asia. [The Barren-ground Bear of North America appears to be undistinguishable.]

It couples in June, and brings forth in January; nestles sometimes very high up in trees; its flesh is good eating when young, and the paws are much esteemed at all ages. [The Black Bear of Europe is now generally regarded as a mere variety.]

The Black Bear (*U. americanus*, Gm.) of North America, is a species well distinguished, with a flat forehead, smooth and black fur, and fulvous muzzle. We have always found the small teeth behind its canines to be more numerous than in the Bear of Europe. It lives chiefly on wild fruits, and where fish is abundant sometimes frequents the shores for the purpose of catching it; resorts to flesh only in default of other food, [and is then destructive to Pigs; is a great devourer of honey, in common with most others of the genus]: its flesh is highly esteemed. There is another Black Bear found in the Cordilleras, with white throat and muzzle, and large fulvous eye-brows (*U. ornatus*, F. Cuv.), [considered by many to be a variety of *U. americanus*. The *Jardin des Plantes*, however, has lately received a Bear from the Peruvian Andes, which appears very distinct: colour of *U. arctos*, with larger ears.

The gigantic Grizzly Bear (*U. ferox*), now a well-known species, from the Rocky Mountains of North America, is the most formidable of all the land Bears, and by much the largest. It can only ascend trees, as the others do, when young. It constitutes the ill-characterized subgenus *Davis* of Gray.

The Syrian Bear (*U. syriacus*) is of a fulvous white colour, with a stiff mane of close erected hairs between the shoulders. The species which inhabits the Atlas chain of mountains remains to be ascertained.]

The East Indies produce several Bears of a black colour; such as

The Malayan Bear (*U. malayanus*); from the peninsula beyond the Ganges to the islands of the Straits of Sunda. —Sleek [with comparatively short fur], a fulvous muzzle, and heart-shaped mark of the same colour upon the chest. [This, and another species, or perhaps variety, (*U. eurypilus*), with the whole chest fulvous, from Borneo, constitute the division *Helarctos* of Horsfield, or the *Sun Bears*. They are small, and of very gentle and playful disposition, easily rendered quite tame.] It is very injurious to the cocoa-nut trees, which it climbs in order to devour the tops, and drink the milk of the fruit.

The Thibet Bear (*U. thibeticus*, F. Cuv.)—Black; the under lip, and a large mark in the form of a Y on the breast, white; profile straight and claws weak. [Is intermediate to the preceding and next species.] From the mountains in the north of India.

The most remarkable, however, of all these Indian Bears is the following, of which Illiger forms his genus *Prochilus*.

\* We shall no longer repeat the words on each side, &c. : it being understood that where the molars of one side are spoken of, those of the other correspond.

† Although it may seem presumptuous to attempt to set Cuvier right in matters of this kind, it is nevertheless sufficiently obvious, on

analogical comparison of the Bear's dentition with that of proximate genera, that the third tooth in succession from behind represents the cutting or carnivorous tooth in each jaw, there being two tuberculous grinders in this and the five succeeding genera (which together compose a distinct natural group), and one only in the remainder.—Ed.



Fig. 34.—The Black Bear.

The Jungle Bear (*U. labiatus*, Blainv. : *U. longirostris*, Tied : *Bradyus ursinus*, Shaw), which has the nasal cartilage dilated, and the tip of the under lip elongated, both lips being moveable : when old, very long shaggy hairs surround the head. The muzzle and tips of the paws are fulvous or whitish, and there is a half-collar or Y-like marking on the fore-neck and cheek. [The incisors of this species generally drop at an early age.] It is a favourite with the Indian jugglers on account of its uncouth appearance.



Fig. 25.—The Jungle Bear.

thrive, like the rest, on vegetable food only. It is the largest of the genus, [and exaggerated reports of its voracity have rendered it very celebrated. [It constitutes the *Thalarchos* of Gray.]

#### THE RACCOONS (*Procyon*, Storr.)—

Have three tuberculous back molars [the first representing the carnivorous tooth], of which the superior are nearly square, and three pointed false molars before them, forming a continuous series to the canines, which are straight and compressed. Their tail is [moderately] long ; but the rest of their exterior is that of a Bear in miniature. They rest the whole sole of their foot on the ground only when they are still, raising the heel when they advance. [Are peculiar to the western continent.]

The Common Raccoon (*Ursus lotor*, Lin. ; *Mapach* of the Mexicans.)—Greyish brown ; the muzzle white ; a brown streak across the eyes : tail annulated with brown and white rings. An animal the size of a Badger, which is easily tamed, and remarkable for a singular instinct of eating nothing that it has not previously dipped in water. It is a native of North America, and subsists on eggs, birds, &c.

The Crab-eating Raccoon (*P. cancrivorus*, Buff. Supp. vi. xxxli.)—Uniform ash-brown ; the caudal rings less distinct. From South America. [Three others have been described by Prof. Wiegmann, (see *Ann. Nat. Hist.* i. 133), of which *P. Hernandezi*, Wagler, would appear to be dubiously separable from *P. lotor*.]

#### THE PANDA (*Ailurops*, F. Cuv.)—

Appears to approximate the Raccoons by its canines and what is known of its other teeth ; except that it has only one false molar. "Gen. Hardwicke has since described it to have four square tuberculous molars, and one trenchant false molar in front, at a short distance from the canine." The head is short ; tail [rather] long ; gait plantigrade, the toes five in number, with half-retractile nails.

Only one is known, the Bright Panda (*A. fulgens*, F. Cuv.)—Size of a large Cat ; the fur soft and thickly set : above of the richest cinnamon-red ; behind more fulvous, and deep black beneath. The head is whitish, and the tail annulated with brown. This beautiful species, one of the handsomest of known quadrupeds, from the mountains of the north of India, was sent to Europe by my late son-in-law, M. Alfred du Vaucel. [It frequents the vicinity of rivers and mountain torrents, passes much of its time upon trees, and feeds on birds and the smaller quadrupeds. Is generally discovered by means of its loud cry or call, which resembles the sound *wha*, often repeated. The soles of its feet are hairy.]



Fig. 22.—*Ailurops fulgens*.

#### THE BINTURONGS (*Idetes*, Valenc. ; *Arctictis*, Tem.)

Are also related to the Raccoons by their dentition ; but the three superior back molars are considerably smaller, and less tuberculous, the last one of each jaw more particularly, which is very small and almost simple. These animals are



covered with long hair, and have a tuft at each ear. The tail is long, hairy, and has a propensity to curl, as if prehensile; [which it really is: their whiskers are long and conspicuous].

They are also natives of India, for the first knowledge of which we are indebted to M. du Vaucel. One species (*Ict. albifrons*, F. Cuv.) is grey, with the tail and sides of the muzzle black; of the size of a large Cat; from Boutan. Another (*Ict. ater*, F. Cuv.) is black, with a whitish muzzle, and as large as a stout Dog; from Malacca. [The latter is merely the male, and the other the female of the same species, which is rather a slow-moving animal, allied to the last in habit, of a timid disposition, and easily tamed. The *Ictids dorés*, F. Cuv., is a species of Musang (*Paradoxurus*).]

#### THE COATIMONDIS (*Nasua*, Storr).—

To the dentition, tail [which however is longer], nocturnal life, and slow dragging gait of the Raccoons, add a singularly elongated and moveable snout. Their feet are semi-palmate, notwithstanding which they climb trees [with great facility, and descend them head foremost, clinging by their hind feet, which they almost reverse]. Their long claws serve them to dig with; [and they feed voraciously on earth-worms, slugs and snails, also on small mammalians (which they catch adroitly), birds and their eggs, together with fruits and vegetables]. They inhabit the warm parts of America, and subsist on nearly the same food as our Martens.

The Red Coatimondi (*Viverra nasua*, Lin.; *N. rufa*, Desm.)—Rufo-fulvous, the muzzle and caudal annulations brown. And the Brown Coatimondi (*V. narica*, Lin.; *N. fusca*, Desm.)—Brown, with white spots over the eye and snout. [These animals employ their claws to divide flesh, which they thus tear and separate before devouring it.]

#### THE KINKAJOU (*Cercoleptes*, Illiger).—

Can scarcely be introduced elsewhere than in this place [which is unquestionably its true position]. To the plantigrade gait, it joins a very long tail, prehensile, as in the Sapajous\*, a short muzzle, slender and extensile tongue, with two pointed grinders before, and three tuberculous ones backward, [the first of which latter represents the carnivorous tooth].

But one species is known (*Viverra caudivoluta*, Gm.), from the warm parts of America and some of the Great Antilles, where it is named *Potto*†: size of a Fitchet, [and larger]; the fur woolly, and of a yellowish [or golden] brown: nocturnal, and of a mild and gentle disposition; subsisting on fruits, honey, milk, blood, &c. [It is eminently an arboreal quadruped, which moves with a cautious gait, recalling to mind some of the *Quadrumana*.]

There is a Mexican animal to which Lichtenstein has assigned the generic name *Bassaris*, and which Blainville and others have associated with the Viverrine genera, but which I greatly suspect must rather be placed near the Kinkajou, though I have not at present the means of ascertaining its characters. In form it is not unlike a Musang (*Paradoxurus*).‡

The remaining genera are only semi-plantigrade (that is, they do not bring the heel quite to the ground), and possess but one tuberculous grinder, which varies greatly in extent of surface: none of them become torpid in winter; and they all emit, when alarmed, a defensive odour, which in many is horribly fetid.]

#### THE BADGERS (*Meles*, Storr),§—

Which Linnæus placed, together with the Raccoons, in his genus of Bears, have one very small tooth behind the canine, then two pointed molars, followed in the upper jaw by one which we begin to recognize as carnivorous, from the trace of a cutting character which it exhibits on its outer side; behind this is a square tuberculous tooth, the largest of the series; and, on the lower jaw, the last but one likewise commences to bear some resemblance to the inferior carnivorous tooth; but as there are two tubercles on its inward border as elevated as its cutting point, it performs the office of a tuberculous one; the last below is very small. [The Badger, in fact, has precisely the same dentition as the Weasels and Otters, presenting a modification of that type for less carnivorous regimen.]

These animals have the tardy gait and nocturnal habit of all the preceding; their tail is short, [and

\* One which I had an opportunity of studying, as it ran about loose in a room, possessed the prehensile power of the tail in an extremely moderate degree, merely resting slightly on this organ, which it stiffened throughout its length, and never coiled in the manner of the Sapajous.—Ed.

† This term, applied by the negroes in Africa to a Lemurine animal (*Perodicticus*), has been introduced by them, and misapplied in other countries.—Ed.

‡ Strong presumptive evidence that the Bassot (*Bassaris*) does not appertain to the Viverrine group, is afforded by the restriction of the geographic range of the latter to the eastern hemisphere, in every other instance. The presence or absence of a coccyx would decide the question.

§ *Meles* of some systematists; but this name is employed in Botany for the Yew genus.—Ed.



## MAMMALIA.

[commonly held erect]. Their toes are much enveloped in the skin; and, what eminently distinguishes them, is a pouch situate beneath the tail, from which exudes a fatty, fetid humour, [as in the Skunks, Weasels, &c., to which the Badgers are very closely allied]. The long claws of their fore-feet enable them to burrow with much facility.



Fig. 28.—Common Badger.

The European Badger (*Ursus meles*, Lin.; *M. taxus*, Auct.)—Greyish above, beneath black, with a dusky band on each side of the head. That of America (*Mel. hudsonius* [?] *M. labradorius*, Sabine; *Ursus taxus*, Schreb.] does not appear to differ essentially. [It is even generically very distinct, pertaining to the next division. A second species of Badger, however, appears to me to exist in the Balyssaur of India (*Arctonyx collaris*, F. Cuv.; *Mydaus collaris*, Gray,) which M. F. Cuvier has represented much too Hog-like in his figure; the snout being scarcely longer than that of the European Badger, the fur somewhat

coarser, and the tail (which almost reaches the ground) not so scantily covered with hair as stated.\* A cranium figured as that of the Balyssaur by Mr. Gray, in his published series of Gen. Hardwicke's drawings, appears to me to indicate another species, distinguished by the long vacant interspace between the inferior canine and first existing molar. This genus would seem to be peculiar to the eastern continent.

### THE TAXELS (*Taxidea*, Waterh.)—

Are the reputed Badgers of America, but which present a very different cranium, and more carnivorous dentition: their cutting molar is increased, and the tubercular reduced, to an equal size; the latter

having a triangular crown: skull widest at the occiput, where it is abruptly truncated; the auditory bullæ much developed; and articulating surface of the lower jaw extended, but not locking as in the Badgers. Their claws are longer and stouter, enabling them to burrow with great rapidity.

One only is clearly ascertained, the *T. labradoria* (*Ursus taxus*, Schreb.) Remarkable for the fine quality of its fur. Dr. Richardson has taken a Marmot from the stomach of this animal.



Fig. 29.—Taxel.

molars; the tubercular of the upper jaw transverse, and smaller than the carnivorous tooth. General conformation similar to that of the Badger, but without external ears.

But one species is known (*N. inauritus*, Hodg., *Asiat. Res.* xix. 60, and *Journ. As. Soc.* v. 621), from the vicinity of Nipal, scantily covered with coarse hair. It is completely plantigrade and fossorial, dwelling in burrows on the southern slopes of the hills, which it seldom leaves during the day.]

### THE BEARSIAN (*Ursotaxus*, Hodgson).

Four cheek-teeth above and below, comprising two superior and three inferior false

### THE WOLVERINES (*Gulo*, Storr)—

Have also been placed in the Bear genus by Linnæus; but they rather approximate the Martens in their dentition and general character, according only with the Bears in their plantigrade gait. They have three false molars above, and four below, anterior to the carnivorous tooth, which is well characterized; and behind this a small tubercular, which is wider than long. Their upper carnivorous tooth has but one small internal tubercle, so that they have nearly the same dental system as the

\* There is a figure, in Bewick's *Quadrupeds*, apparently of this species, taken from a seemingly unhealthy individual confined in the Tower Menagerie. The description intimates its near resemblance to the common Badger.

**Martens.** These animals have the tail of middle length, with a fold beneath it in place of a pouch; and their foot is very similar to that of a Badger.

The most celebrated species is the *Glutton* of the north, *Rossomak* of the Russians (*Ursus gulo*, Lin.); size of a Badger, and commonly of a fine deep maroon colour, with a browner disk on the back; but sometimes it is paler. It inhabits the glacial regions of the north, is reputed to be very sanguinary and ferocious, hunts by night, does not become torpid during the winter, and subdues the largest animals by leaping upon them from a tree. Its voracity has been absurdly exaggerated by some authors. The Wolverine of North America (*Ursus luscus*, Lin.) does not appear to differ by any constant characters, but is generally of a paler tint. [Excepting in size and massiveness, I cannot perceive that this animal differs from the Martens: assuredly it does not in the structure of its feet.]

Warm climates produce some species which can only be placed near the Wolverines, from which they differ merely in having one false molar less to each jaw, and by a longer tail. Such are the animals termed by the Spanish inhabitants of North America *Ferrets* (*Hurons*), and which in point in fact have the dentition of our Ferrets and Weasels, and lead the same kind of life; but they are distinguished by their semi-plantigrade carriage, [or rather by having their soles uncovered with hair]. Such are

The Grison (*Viverra vittata*, Lin.)—Black, the top of the head and neck grey, a white band reaching from the forehead to the shoulders. [This constitutes the *Grisonia*, Gray, and with an allied species, *le petit furet* of Azzara (*Gallotis Allamandi*, Bell), the *Gallotis*\* of the last-named naturalist, who places them contiguous to the Weasels. They are small animals, easily rendered very tame, and extremely playful in domestication; of very carnivorous disposition, and particularly fond of eggs.]

The Taira (*Mustela barbara*, Lin.) [Subdivision *Taira* of Gray.]—Brown [or brownish-black]; the head grey; [and sometimes] a large white spot under the throat. [The fur remarkably short.]

These two animals are distributed throughout the warm parts of America, and exhale an odour of musk. Their feet are a little palmated, and it appears that they have been sometimes taken for Otters.† [We conceive that the Wolverine might be advantageously removed to the genus of Martens; and would restrict the term *Gulo* to the others. The Grisons diffuse when irritated a disgusting stench.]

#### THE RATELS (*Mellivora*, F. Cuv.)—

Have a false molar to each jaw still less than the Grisons, and their upper tuberculous tooth but little developed, so that they approximate the Cats in dentition; but their whole exterior is that of the Grison, or [rather] of a Badger. The legs are short; feet [semi-]plantigrade, and five toes to each; the claws very strong, &c.

But one species is known (*Viverra mellivora*, Sparrm., and *Viv. capensis*, Schreb. pl. 125), of the size of the European Badger; grey above, black below, with a white line that separates the two colours; sometimes it is almost wholly white above. It inhabits the Cape of Good Hope, and burrows into the ground with its long claws, in search of the honey-combs of the wild Bees.

#### THE DIGITIGRADA—

Form the second tribe of CARNIVORA, the members of which walk on the ends of their toes.

In the first subdivision of them [all the members of which are semi-plantigrade], there is only one tuberculous grinder behind the upper carnivorous tooth: these animals, on account of the length of their body, and shortness of the limbs, which permit them to pass through very small openings, are styled *vermiform* [*vermin*]. They are destitute of cæcum, like the preceding, but do not pass the winter in a state of lethargy. Although small and feeble, they are very sanguinary and ferocious. Linnæus comprehended them all under one genus, that of

#### THE WEASELS (*Mustela*, Lin.)—

Which we will divide into four subgenera.

##### THE TRUE WEASELS (*Putorius*, Cuv. [*Mustela*, Ray.] )—

Are the most sanguinary of any: their lower carnivorous tooth has no internal tubercle, and the upper tuberculous one is broader than long; there are only two false molars above and three below. These animals may be recognized by having the extremity of the muzzle somewhat shorter and blunter than in the Martens. They all diffuse [when alarmed] a fetid stench; [take the water, and dive with facility, having the toes semipalmated; trace their prey by scent, and kill it by inflicting a wound in the neck: the female is commonly much smaller than the male.

\* This must not be confounded with the *Gallotis* of Is. Geoffroy (Compte rendu, Oct. 1837), which refers to the *Mustela* or *Putorius* *lividus* of Cuvier.—Ed.

† It is supposed from the description given by Macgregor of his *Carigineibela*, which name Buffon has applied to his *Sarcocouine*, vol. xiii. p. 319, that he meant to speak of the Taira.

There are very many species, three of which inhabit Britain:—The Fitchet Weasel, or *Polecat*, of which the Ferret appears to be a domesticated variety\*; the Stoat, or Ermine, which in cold countries (and occasionally even in South Britain) becomes pure white in winter, except the end of its tail, which always continues black; and the Common Weasel, of diminutive size, which preys chiefly on Mice and other small animals injurious to the agriculturist. It is a curious fact that in several instances the female Polecat has been known to stow away many Frogs and Toads in an apartment of its burrow, disabling each without killing it, by puncturing the skull. The Common Weasel traverses the boughs of trees, tops of palings, &c., with facility, and will spring from the ground upon a Partridge flying near the surface. *Put. striatus*, Cuv., a small Madagascar species, reddish-brown, with five longitudinal white stripes, composes the division *Galeotis* of Isidore Geoffroy (not of Bell); and *Put. Zorilla*, Cuv., a species marked with broken stripes of white, and possessing a more snout-like muzzle, the tail of which also is longer and more bushy, is the *Zorilla capensis* of some recent authors: there would appear, indeed, to be several species of these Zorilles.]

#### THE MARTENS (*Mustela*, Cuv. [*Martes*, Ray])—

Differ from the true Weasels by having [commonly] an additional false molar above and below, and a small tubercle on the inner side of their carnivorous tooth; two characters which somewhat diminish the ferocity of their nature. [They are handsome, and remarkably lithe active animals, with larger ears than the Weasels, and fine bushy tails; are also more arboreal in their habits. The scent they diffuse when irritated is not disagreeable.†]



Fig. 27.—The Marten.

There are two species in Europe, very closely allied together. The Yellow-breasted or Pine Marten (*Mustela martes*, Lin.), inhabiting wild districts, and the White-breasted or Beech Marten (*M. foina*, Lin.), which frequents woods near human habitations. [Many consider these to

be varieties merely of the same; but on examining several crania, I have noticed that the former are constantly smaller, with the zygomatic arch fully twice as strong as in the other. The American species usually deemed identical with *M. foina*, is intermediate. There are numerous others, as the Pekan or Fishing Marten of Canada, &c.; and the Sable of commerce (*M. sibirica*, Auct.), celebrated for its beautiful fur, is a member of this division. In the Sable and several others, the soles are completely covered with close fur; but in *M. flavigula* of the Himalayas, the under surface of the foot is naked, and the toes joined to their extremities, as in the Badgers, &c.]

#### THE SKUNKS (*Mephitis*, Cuv.)—

Possess, like the Weasels, two false molars above and three below; but their superior tuberculous grinder is very large, and as long as broad, and their inferior carnivorous tooth has two tubercles on its inner side, thus approximating these animals to the Badgers, in the same way as the Weasels are related to the Grisons and Wolverine. In addition to this, the Skunks accord with the Badgers in having their anterior claws long, and adapted for burrowing, and they are even semiplantigrade, [and equally slow in their movements]. This resemblance extends even to the distribution of their colours. [The truth is, they scarcely differ from the Badgers, except in having a remarkably fine and large bushy tail, which is borne elevated, like the small short tail of the Badgers.] In the present family, notorious for diffusing a fetid stench, the Skunks are pre-eminently distinguished by emitting a most intolerable odour.

These animals are mostly striped longitudinally with white on a black ground, but the number of stripes appears to vary even in the same species; [not, however, I think, to the extent that has been supposed; for there are several species, distinguishable by their osteology, which agree sufficiently in their general style of colouring, allowing for some variation on the part of each, to induce the supposition, judging only from external characters, that they might all be referred to one. The intensity of their most nauseous suffocating stench, which has been described to resemble that of the Fitchet mingled with assafetida, is scarcely credible: it appears, however, to be emitted only in self-defence. The geographic range of this genus is confined to America].

We may make an additional subgenus of

#### THE TELEDU (*Mydaus*, F. Cuv.)—

Which, together with the dentition, [the teeth, however, being smaller (from which results a more

\* I have sought in vain for any osteological distinction between these animals.—Ed.

† Hence our native species are designated *Sweet-mart*, in opposition to *Foul-mart*, or *foul mart*, a common name for the Polecat.—Ed.

elongated muzzle), the canines placed further backward, and the molars more sharply tuberculated, recalling to mind those of the *Insectivora*], feet, and colouring even of the Skunks, have the muzzle truncated, so as to assume the form of a snout, and the tail reduced to a small pencil, [which, however, is also held erect, as in the Badgers, &c.] Only one species is known,—

The Javanese Teledu (*Mid. melacope*, F. Cuv.)—[Brownish] black, the nape of the neck, a stripe along the back, and tail, white; the dorsal stripe sometimes interrupted about the middle. [Fur soft and rather fine.] Its stench is equally horrible with that of the Skunks, [and precisely similar, as I am informed by Dr. Horsfield, who has had experience of both: it subsists principally on earth-worms, for which it turns up the light soil with its snout, in the manner of a Hog; is easily tamed, and by no means offensive in captivity; and it is especially remarkable for its restriction to a particular elevation on the mountains of Java, below which it is never found.]

We may here also introduce

THE NYENTEK (*Helictis*, Gray; *Melogale*, Is. Geoff.)—

The body of which appears to be more lengthened and vermiform, and the tuberculous molar small and transverse: it is described to have three false molars above, and four below; the upper carnivorous tooth three-lobed, with a broad two-pointed internal process: soles of the feet bare, and toes united.

The Nyentek of the Javanese (*Gulo orientalis*, Horsf.; *H. moschatus*, Gray.)—Size of a Polecat: brown, with a white stripe along the back, crossed by another less distinct over the shoulders, and a white spot on the head; tail of mean length. This animal inhabits eastern Asia, and smells strongly of musk: it is one of the few Mammalia known in Europe to inhabit China, where the larger indigenous species are supposed to have been exterminated.]

THE OTTERS (*Lutra*, Storr)—

Have three false molars above and below, a strong process to the upper carnivorous tooth, an internal tubercle to the lower one, and a large tuberculous grinder that is nearly as long as broad; their head is flattened, and the tongue rather rough. They are distinguished from all the preceding genera by their [more completely] webbed toes, and horizontally flattened tail,—two characters which proclaim them to be aquatic animals: they subsist on fish.

The European Otter (*Must. lutra*, Lin.)—Brown above, whitish round the lips, on the cheeks, and the whole under parts. The rivers of Europe [and sometimes the sea-coast. Is occasionally spotted above with white. The species of this extensive genus, which is almost generally diffused, are mostly very similar externally, and are best distinguished by the configuration of the cranium, &c.] That of India (*L. noir*, F. Cuv.) is employed for fishing, as the Dog is for hunting. The Cape Otter (*L. capensis*, F. Cuv.) is remarkable (at least at a particular age) for having no nails; a character on which M. Lesson has founded his genus *Aonyx*: young individuals, however, have been received from the Cape, which possess nails; and it remains to ascertain whether they are of the same species. The American Otter (*M. brasiliensis*), from the rivers of both Americas, has the extremity of the muzzle, which in most other animals is naked, covered with close fur: [it is also very gregarious in its habits. But the most remarkable species is the great Sea Otter (*Mustela lutris*, Lin., composing the division *Enhydra* of Fleming. It is twice the size of the European species, from which it differs in the form of its hind feet, which have the outermost toe longest. The adults have but four lower incisors, the exterior pair being doubtless forced out by the canines.] Its blackish velvet-looking fur is extremely valuable, to obtain which the English and Russians hunt the animal throughout the northern shores of the Pacific Ocean, for the purpose of disposing of it to the Chinese and Japanese. [A species intermediate to the Sea Otter and the others constitutes the *Pteronura*, Gray. M. Temminck has received a new genus allied to the Otters, which he names *Potamophilus*.

We here arrive at the termination of an extensive and very distinct natural group, which falls under two principal subdivisions, the limits of which, however, are not easy to define.

The first consists of exclusively ground animals, with a thick and heavy body, stout limbs, and strong claws adapted for burrowing with rapidity. It comprises the Badgers, Teledu, Skunks, Taxels, Bharsiah, and Ratel; nearly all of which ordinarily erect the tail, and are more or less striped longitudinally.

The remainder are vermiform and agile, and most of them ascend trees with facility: they are also more predatory, though some of the former (as the Ratel) possess an equally carnivorous dentition: many are marked similarly to the preceding.

The Zorilles might almost be referred to either section; but we prefer retaining them near the Weasels.]

The second subdivision of the DIGITIGRADA [being the first, strictly so named,] possesses [like the *Ursidae*] two flat tuberculated molars posterior to the upper carnivorous tooth\*,

\* There are three tuberculous molars to each jaw in the *Canis* (*Mygalotis*) *Lelandi*, and De Blainville figures the cranium of a common Dog in which the same was observable.—Ed.

which has itself a large internal process. They are carnivorous animals, but not predatory in proportion to their strength, and often feed on carrion. They have all a small cæcum.

#### THE DOGS (*Canis*, Lin.)—

Have three false molars above, four below, and two tuberculous grinders behind each carnivorous tooth. The first of these upper tuberculous molars is very large. Their superior carnivorous tooth has only a small internal tubercle; but the inferior one has its hinder portion altogether tuberculous. The tongue is soft; the fore-feet have five toes, and the hind-feet [in general] only four. [The cæcum is of a peculiar spiral form.]

The Domestic Dog (*C. familiaris*, Lin.)—Distinguished by its recurved tail, but otherwise varying infinitely with respect to size\*, form, colour, and quality of the hair. It is the most complete, the most singular, and useful conquest ever made by Man; the whole species having become his property; each individual is devoted to its particular master, assumes his manners, knows and defends his property, and remains attached to him until death; and all this, neither from constraint nor want, but solely from gratitude and pure friendship. The swiftness, strength, and scent of the Dog have rendered him a powerful ally to Man against other animals, and were even, perhaps, necessary to the establishment of society. It is the only animal which has followed Man all over the world.

Some naturalists think the Dog is a Wolf, and others that he is a domesticated Jackal; but those which have become wild on desert islands resemble neither one nor the other.†

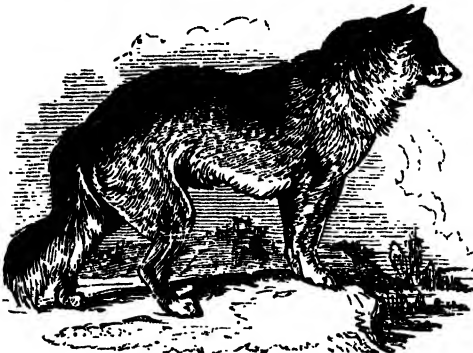


Fig. 28.—The Dingo, or Australian Dog.

The wild Dogs, and those which belong to savages, such as the inhabitants of Australia, have straight ears, whence has arisen a belief that the European races, nearest to the original type, are our *Shepherd's Dog* and *Wolf Dog*; but comparison of the crania indicates a closer approach on the part of the French *Mâtin* and *Danish Dog*, after which follow the *Hound*, the *Pointer*, and the *Terrier*, which chiefly differ in size and the relative proportions of parts. The *Greyhound* is more attenuated, and has the the frontal sinus smaller, and scent weaker. The *Shepherd's Dog* and *Wolf Dog* resume the straight ears of the wild ones, but with greater development of brain, which continues to increase, together with the intelligence, in the *Barbet* and *Spaniel*. The *Bull-dog*, on the other hand, is remarkable for the shortness and strength of its jaws. The small pet Dogs, the *Pugs*, lesser *Spaniels*, *Shocks*, &c., are the most degenerate productions, and exhibit

the most striking marks of that influence to which Man subjects all nature.

The Dog is born with its eyes closed; it opens them on the tenth or twelfth day; its teeth commence changing in the fourth month, and its full growth is attained at the expiration of the second year. The female remains with young sixty-three days, and produces from six to ten young at a birth. The Dog is old at fifteen years, and seldom

\* A specimen, which attained two years of age, and is preserved in the Museum of Dresden, measured only five inches and a half in length; this being exactly the same length, from the corner of the eye to the tip of the nose, of a Saxon boar-hound examined by Col. Hamilton Smith.—Ed.

† If the idea, which I conceive there is every reason to entertain, respecting the origin of the Domestic Dog be well founded, it is clear that a recurrence to a single wild type would be impossible. The Dog is apparently a blended race, derived principally from the Wolf, and partly from various other allied species. In the Museum of the Zoological Society of London, there is a specimen of an *Equilaxus Dog*, which resembles the large American Wolf (*C. nubilus*) so closely, that there can scarcely be any doubt of the connexion which subsists between them; and it is well known, of the American Wolves in particular, that if a young animal be surprised by a hunter, and suddenly menaced by his voice and manner, it will crouch to him and implore his mercy in precisely the manner of a spaniel; so that only a little encouragement and kindness are required to gain its permanent attachment; indeed, many of them are killed to obtain the proffered reward, by taking this (assuredly unworthy) advantage of their natural submissiveness. That the Wolf possesses the mental qualities, and is capable of the same strong attachment to Man as the most faithful Dog, has been abundantly proved by the observations of M. F. Cuvier and others; and the unrelenting persecution to which it has been necessarily subjected in Europe for so many ages, will sufficiently

account for the savage and distrustful character which it exhibits when unclaimed; though even then the germs of a better disposition are traceable in the permanent attachment of the male and female, and sociability of the young till urgent necessity, or the annual period of dominant sexual excitement, subdues every milder propensity and acquired sentiment of friendship or disinterested affection.

In the late edition of Dr. Prichard's work on Man, an old error is revived, which originated with Buffon, but which that naturalist afterwards corrected; namely, that the period of gestation in the Wolf is much shorter than in the Dog. It is precisely the same in both animals.

Instances occasionally happen of the Dog returning by choice to a state of wildness, and assuming then, of necessity, the character ascribed to the Wolf. I have known this to occur in a male pointer, and in a female greyhound: the latter was so fine a specimen of the breed, that on being entrapped, it was thought desirable to obtain a litter from her, which was accordingly effected; but, while her puppies were very young, she managed to escape to the woods, and never returned: three of her progeny grew to be excellent hounds; but two others proved quite irreclaimable; and escaping from servitude, like their dam, were finally shot, for their destructive poaching propensities.

It is not unusual to trace the peculiar markings, and grizzled colouring of the back, common to most of the wild species of *Canis*, in domestic Dogs, of various size and character.—Ed.

lives beyond twenty. Every one is acquainted with its vigilance, bark, singular mode of copulation, and susceptibility of various kinds of education.

The Wolf (*C. lupus*, Lin.)—A large species, with a straight tail; the most noxious of all the *Carnivora* of Europe. It is found from Egypt to Lapland, and appears to have passed over to America. Towards the north, its coat becomes white in winter. It attacks all our animals, but does not evince a courage proportioned to its strength; it often feeds on carrion. Its habits and physical development are closely related to those of the Dog. Another species, the Black Wolf (*C. lycaon*) is sometimes, though rarely, found in France. The Mexican Wolf (*C. mexicanus*, Lin.) has the under part of the body and the feet white.

The Red Wolf (*C. rubra*, Az.)—A fine cinnamon red, with a short black mane along the spine. From the marshes of South America. [The beautiful fur of this animal renders it one of the handsomest of the genus.]

The Jackal (*C. aureus*, Lin.) [division *Vulpicantis*, Blainv. and *Jaculus*, Hodg.]—A voracious species, which hunts like the Dog [in packs], and in its conformation and the facility with which it is tamed, resembles the latter more nearly than any other wild species. Jackals are found from the Indies and the environs of the Caspian Sea, as far as Guinea inclusive; but it is doubtful whether they all belong to the same species. [There are now several well-known species of these animals. The *Canis primævus*, Hodg., *C. dukhunensis*, Sykes, is a large red Jackal, or Jackal-like Dog, inhabiting India, and very like the Dingo of Australia.]

FOXES [*Vulpes* of some naturalists] may be distinguished from Wolves and Dogs by having the tail longer and more bushy [though in this respect there is no drawing the line of separation], by a more pointed muzzle, and pupils which, during the day, form a vertical fissure; also by their upper incisors being less sloping; they emit a fœtid odour [scarcely less offensive in the Jackals], dig burrows, and attack only the weaker animals; [are also more frugivorous than the preceding.\*] This subgenus is more numerous than the foregoing.

The Common Fox (*C. vulpes*, Lin.)—More or less rufous, with the extremity of the tail [generally] white. Is found from Sweden to Egypt, (though many of those of the south of Europe appertain to a different species, *C. melanogaster*, Savi, which is smaller and less carnivorous than the Common Fox, and differs somewhat in habit.† There are very many others, almost generally diffused over the globe. We can only mention]

The Arctic or Blue Fox, or Isatis (*C. lagopus*, Lin.)—Deep ash-colour, often white in winter; the under surface of the toes hairy, (though several of the Foxes, and even the common one, have hair under the feet in the north). From the glacial regions of both continents, particularly the north of Scandinavia; is much esteemed for its fur.

The interior of Africa produces Foxes remarkable for the size of their ears, and the strength of their whiskers; they compose the *Megalotis*, Illiger. Two are known, the

*C. megalotis*, Lalande [*Megalotis Lalandi* of some authors], a Cape species, somewhat smaller than the Common Fox, but higher on its legs; [especially remarkable for possessing three tuberculous molars posterior to the cutting grinder of each jaw: its teeth become much worn with use, whence it would appear to be mainly frugivorous.] And

The Zerde, or Fennec of Bruce (*C. zerda*, Gm.), which has ears still larger; it is a very small species, almost of a whitish fulvous, with woolly hair extending beneath the toes; burrows in the sands of Nubia, [and ascends the trunks of trees with facility: dentition that of an ordinary Fox.]

Finally, we may place after the Dogs, as a fourth subgenus, distinguished by the number of toes, which are four to each foot,

The Wild Dog of the Cape (*Hyæna venatica*, Burch; *H. picta*, Tem. [*Lycæon picta*, Brookes]), which has the dental system of the Dogs [Civets, &c.], and not of the Hyænas; a tall gaunt form; fur marbled with white, fulvous, grey, and blackish; the size of a Wolf, with large ears tipped with black, &c. It lives in numerous packs, which often approach Cape-town, and devastate the environs. [This remarkable species

\* The common Dog is an eager devourer of gooseberries, of which it will soon strip the bushes to which it has access.—En.

† It is remarkable that many of the habits attributed to the

Fox, in the old Greek fables, apply better to *C. melanogaster* than to *C. vulpes*.—En.



Fig. 29.—The Black Fox.

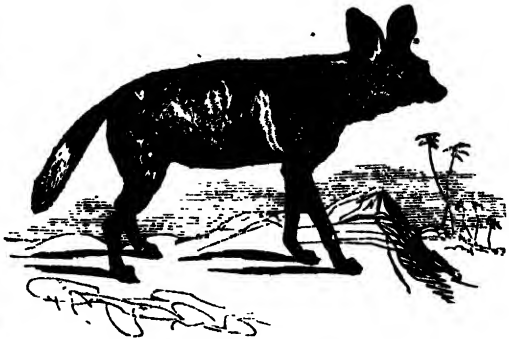


Fig. 30.—The Marbled Lycæon.

is Dog-like, but certainly not a *Canis*: its form and colouring (and there is reason to suspect its internal conformation), are rather those of a Hyæna; and it is known to copulate in the manner of those animals, and not in the peculiar manner of the Dogs and Foxes. Even its dentition is the same as that elsewhere found, (with one other exception,—*Proteles*,) throughout the group to which we conceive the Hyænas to belong, the dental system of which latter appears to be modified in accordance with their much increased and prodigious strength of jaw.]

#### THE CIVETS (*Viverra*),—

Have three false molars above and four below, the anterior of which sometimes fall out; two tolerably large tuberculous teeth above, one only below, and two tubercles projecting forwards on the inner side of the lower carnivorous tooth, the rest of that tooth being tuberculous. The tongue is covered with sharp and rough papillæ. Their claws are more or less raised as they walk; and near the anus is a pouch more or less deep, where an unctuous and often odorous matter is secreted by peculiar glands.

They divide into four subgenera.

#### THE TRUE CIVETS (*Viverra*, Cuv.),—

In which the pouch, large, and situate between the anus and the genitals, divided also into two sacs, is abundantly supplied with a pommade having a strong musky odour, secreted by glands which surround the pouch. This substance is an article of commerce, much used in perfumery. It was more employed when musk and ambergris were little known. The pupil of the eye remains round during the day\*, and their claws are only semi-retractile.

[Four species are known, from Africa and India: beautiful spotted animals, larger than a domestic Cat: they have an erectile mane along the back (as in the Hyænas), more or less conspicuous: are of an indolent disposition, and easily tamed; feed partly on fruits; and when irritated raise the dorsal mane, and hiss like Cats.]



Fig. 81.—The African Civet.

#### THE GENETS (*Genetta*, Cuv.),—

Have the pouch reduced to a slight depression formed by the projection of the glands, with scarcely any discernible secretion, although diffusing a very perceptible odour. In the light, their pupil forms a vertical fissure; and their claws are completely retractile, as in the Cats. [They are smaller and more slender animals than the Civets, from which they scarcely differ in style of colouring: are also partly, but less, frugivorous, and in general easily tamed.]

The species are numerous, and inhabit the same general locality as the preceding. One (*Viv. genetta*, Lin.) is found from the south of France to the Cape of Good Hope. It frequents the edges of brooks, near springs, &c., and its skin forms an important article of traffic.

#### [THE GALET (*Cryptoprocta*, Ben.)—

Would appear, from its dentition, to be the most carnivorous of the Viverrine quadrupeds: its jaws are much abbreviated, and there are only two false molars to each: claws wholly retractile.

The species (*C. ferax*, Ben.) is little larger than a Stoat, and uniformly brown, with large ears: an inhabitant of Madagascar. *Eupleres* (Jourdan?) would seem to be allied.

#### THE DELUNDUNG (*Prionodon*, Horsf.)—

Is also allied to the Genets, but with the false molars three-lobed or serrated.

*Felis* and subsequently *Pr. gracilis*, Horsf., is the only species; a rare Javanese animal, of slender form, very handsomely streaked and spotted.]

\* Indicating that they inhabit the open country. See the Cats (*Felis*).—Ed.



THE MUSANGS (*Paradoxurus*, F. Cuv.)—

Possess the teeth and most of the characters of the Genets, with which they were long confounded: but their general form is stouter, and their gait plantigrade: what more particularly distinguishes them, however, is the spiral inclination of the tail\*, which is not prehensile.

Only one species is known, the Pougonné of India (*P. typus*, F. Cuv.), termed *Palm Marten* by the French in India. [No less than ten or twelve have since been discovered, chiefly from India and the great Asiatic islands, though some inhabit Africa. They feed much on fruit, but are also tolerably carnivorous, springing upon their prey from a place of ambush: gait slow and plantigrade, with the head and tail lowered, and the back arched; but they also advance by rapid digital bounds, and are excellent climbers, constructing a nest on the forked branches of trees. They are easily tamed, and, when angry, growl and spit like Cats: sleep rolled up in a ball, &c.]

As the Dogs may be considered the highest of the *Carnivora*, and the Cats the most eminently predaceous, so the Musangs may be regarded as presenting the fairest *average* of a member of this division. Their dentition is scarcely distinguishable from that of the Dogs; but, on reverting the cranium, their cerebral cavity is seen to be proportionally smaller.

Various species of Musang have been named as separate subgenera by different systematists. *Amblodon*, Jourd., is the *Ichide dorde* of M. F. Cuvier; and *Paguma*, Gray, refers to the young of *P. larvatus*. *P. Biebicus*, Gray, a species approximating the Genets, of a fulvous-grey colour, with broad cross bands of dark brown, is the *Hemigalea sebra* of Jourdan. Most of them present the streaks and spots of the Genets, but on a darker ground-tint.

Several affect the vicinity of human habitations, and are very destructive to poultry, their eggs, &c.]

THE CYNOGALE (*Cynogale*, Gray; *Limictis*, Blainv.)—

Is an aquatic representative of the preceding, to which it bears a similar relation to that which the Otters hold with the Weasels. Its false molars are large, compressed, sharp, and slightly notched or serrated; and entire dental system, together with its external characters, generally modified for a piscivorous regimen.

One species only is known (*C. Bennettii*, Gr.; *Viv. and Lim. carcharias*, Bl.)—A native of Sumatra, uniform dark brown; the ears small; head, and also colouring, very similar to that of a common Otter: its tail, however, is cylindrical.]

THE MANGOUSTES (*Mangusta*, Cuv.; *Herpestes*, Ill.†)

The pouch voluminous and simple, and the anus situate within its cavity; [bony orbits of the skull most usually perfect.] Their hairs are annulated with pale and dark tints, which determine the general colour of the eye. [Tail long as in the preceding subdivisions, and bushy towards its insertion.]

The species are very numerous; and] that of Egypt (*Viv. ichneumon*, Lin.), so celebrated among the ancients by the name of *Ichneumon*, is grey, with a long tail terminated by a black tuft; it is larger than our Cat, and as slender as a Marten. It chiefly hunts for the eggs of the Crocodile, but also feeds on all sorts of small animals; brought up in houses [where, in common with its congeners, it is readily domesticated, and exhibits much intelligence and attachment], it pursues Mice, reptiles, &c. By the Europeans at Cairo it is designated *Pharaoh's Rat*, and *Nems* by the natives. The ancient allegation of its entering the throat of the Crocodile, to destroy it, is quite fabulous. The common Indian species (*Viv. mungos*, Lin.) is celebrated for its combats with the most dangerous serpents; and for having led us to a knowledge of the *Ophiophis mungos* as an antidote to their venom. [Some are less vermiform in their make, and higher on the legs: one, termed the *Vansire* by Buffon, forms the division *Athyax* of M. F. Cuvier; others compose the *Galidea* and *Ichneumonina* of M. Is. Geoffroy; *Cynictis*, Og., includes several species with only four toes to each foot; and *Lasiopus* and *Mongo*, Auct., are additional dismembersments of this genus. The *Urva* of Mr. Hodgson appears also to be a Mangouste, with incomplete orbits.]

THE SURIKATE (*Ryzana*, Ill.)—

Resembles the Mangoustes, even to the tints and annulations of its fur; but is distinguished from them, and from all the *Carnivora* hitherto mentioned [save the *Lycan picta* and *Cynictis*, just indicated], by having only four toes to each foot. It is also higher upon the legs, and does not possess the small molar immediately behind the canine. The pouch extends even into the anus.

Only one is known (*Viv. tetradactyla*, Gm.), a native of Africa, and rather smaller than the Mangouste of India.

THE MANGUE (*Crossarchus*, F. Cuv.)—

Has the muzzle, teeth, pouch, and gait of the Surikate; the toes and genital organs of the Mangoustes.

\* In those which I have seen alive, including *P. typus*, this character was not perceptible: the individual figured by M. F. Cuvier presenting a morbid deformity, an analogous instance of which occurred in a Leopard formerly exhibited in London.—Ed.

† This term is more generally adopted. The name *Ichneumon*, formerly applied to the animals of this genus, has been transferred to a very extensive group of Hymenopterous Insects.—Ed.



We know but of one (*Cr. obscurus*, F. Cuv.), from Sierra Leone: size of a Surikate. [Other *Mangoustes* are included by recent systematists; and it may be remarked that both this and the preceding subdivision are merely slight modifications of *Herpestes*, and have similar perfect orbits.]

We shall here mention a singular animal from South Africa, which is known only when young, and which has five toes before, four behind, and the head a little elongated as in the Civets, the legs raised, those behind rather shorter, and a mane as in the Hyæna; and which also resembles the Striped Hyæna very remarkably in its colouring. Its anterior thumb is short, and placed high up. The *Proteles*

*Lalandi*, Is. Geol.; an inhabitant of caverns.

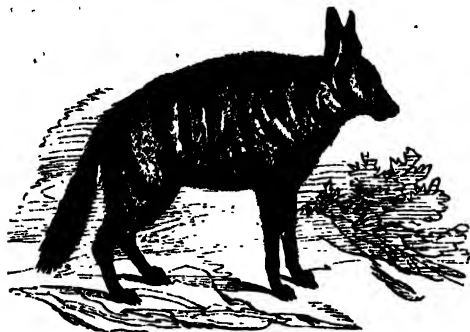


Fig. 32.—*Proteles Lalandi*.

The individuals examined, which were all young, possessed but three small false molars, and one small tuberculous back molar. It seems as though their teeth had never come to perfection, as often happens in the Genets. (See my *Ossemens fossiles*, iv. 388.) [The permanent canines are of tolerable size, but the simple form of the molars, all very small, and separated by intervals, presents an anomaly among the *Carnivora*, which is even more remarkable on account of the affinity of this species to the Hyænas. It is destructive to very young lambs, and is stated to attack the massive fatty protuberance on the tails of the African Sheep.]

The last subdivision of the Digitigrades has no small teeth whatever behind the large molar of the lower jaw. It contains the most sanguinary and carnivorous of the class. There are two genera.

#### THE HYÆNAS (*Hyæna*, Storr)—

Have three false molars above and four below, all conical, blunt, and singularly large: their upper carnivorous tooth has a small tubercle within and in front; but the lower one has none, presenting only two stout cutting points. This powerful armature enables them to crush the bones of the largest prey. Their tongue is rough [exhibiting a circular collection of retroflected spines]; all their feet have each but four toes, as in the Surikate; and under the anus is a deep and glandular pouch, which led the ancients to believe that these animals were hermaphrodite. The muscles of their neck, and of the jaws, are so robust, that it is almost impossible to take from them anything they may have seized; whence, among the Arabs, their name is the symbol of obstinacy. It sometimes happens that their cervical vertebrae become ankylosed in consequence of these violent efforts; and thus has arisen the opinion that the animals of this genus have only one bone in their neck. They are nocturnal animals, and inhabit caverns; voracious, subsisting chiefly on dead bodies, which they will even disinter from the grave, a habit that has given rise to a multitude of superstitious traditions.

Three species are known. The striped Hyæna (*H. vulgaris*, *Canis hyæna*, Lin.), found from India to Abyssinia and Senegal. The spotted H. (*H. crocuta*, Schreb., *C. crocuta*, Lin.), from South Africa; and the Woolly Hyæna, (*H. brunnea*, Thunb., *H. villosa*, Smith), also from South Africa. Remains of a fossil species (*H. spelæa*) are found in many cavern deposits of France, Germany, and England. [Hyænas are easily tamed, if allowed their liberty, and are susceptible of strong attachment to those who use them kindly: many are employed in the capacity of watch-dogs both in Asia and Africa. They are physiologically nearly related to the Civets, and not to the Dogs\*; and the loss of the posterior tuberculous molar appears to be a consequence of the great increase in size of the carnivorous grinders: notwithstanding which these animals feed much on bulbs.]

#### THE CATS (*Felis*, Lin.)—

Are, of all the *Carnaria*, the most completely and powerfully armed. Their short and rounded muzzle, short jaws, and especially their retractile talons, which, being raised upward when at rest, and closing within the toes, by the action of elastic ligaments, lose neither point nor edge, render them most formidable animals, more particularly the larger species. They have two false molars above, and two

\* Their rough tongue, small and not spiral cecum, the structure of their reproductive organs, and consequent mode of copulation; their anal pouch, style of colouring, &c., combine to indicate their true position to be as above assigned.

below: the upper carnivorous tooth three-lobed, with a broad heel on its inner side; the inferior with two pointed and cutting lobes, and without any heel; finally, they have only one very small upper tubercular, and no corresponding one in the lower jaw. [These animals creep unawares upon their prey, and seize it with a sudden spring, in which they expend their energy.] The species are exceedingly numerous, and vary much in size and colour, but they are all nearly similar in structure. We can only subdivide them by characters of trivial import, as size, and the length of fur.

At the head of this genus ranks

The *Lion* (*Felis leo*, Lin.), the most powerful of the beasts of prey; distinguished by its uniform tawny colour, the tuft of black hair at the end of the tail, and the flowing mane which clothes the head, neck, and shoulders of the male. Formerly inhabiting the three divisions of the ancient world, it appears to be now confined to Africa, and the neighbouring parts of Asia. Its head is squarer than in the following species. [The *Lion* is subject to considerable variation, chiefly as regards the quantity of mane, and lengthened hair on other parts: those of Guzerat are almost destitute of any; the *Lions* of Africa present the greatest quantity, in many of which there is a median line of long hair extending along the belly; but even these differ one from another: there is also considerable difference of physiognomy between the African and Asiatic *Lions*, and the latter are always paler, and reputed to be less courageous; but there is no difference of size and apparent strength. Those who distinguish the *Lions* of Asia and Africa as different species, might change their opinion on seeing the various adults now living in London.]

*Tigers* are large species with short hair, and commonly exhibiting vivid markings. [We may here observe that it is quite impossible to subdivide the genus *Felis* into definite sections, and that every attempt of this kind hitherto made has consequently proved a complete failure: the transition into the *Lynxes* is most gradual; and the spotted species (as the *Lion*, *Puma*, &c.) are marked like the rest when young. Those species, however, which affect the open country, as the *Lion* and *Leopard*, have the pupil of the eye contracting to a point; whereas in those which inhabit forests, as the *Tiger* and domestic *Cat*, the pupil closes to a vertical line, permitting thus, when least dilated, of a full range of vision, in the direction in which these animals chiefly watch for prey. A few of the more conspicuous may be briefly indicated.]

The *Tiger* (*F. tigris*, Lin.).—As large as the *Lion*, but with the body longer and head rounder; of a bright reddish-buff above, with irregular black transverse stripes, and pure white underneath; [the hair surrounding the head elongated]: the most cruel of quadrupeds, and the scourge of the East Indies. Such are the strength and the velocity of its movements, that during the march of an army it has been known to seize a soldier while on horse-back, and bear him off to the jungle, without affording a chance of rescue. [This species also occurs, sparingly, in northern Asia. Its markings vary much in different individuals.]

The *Jaguar* (*F. onca*, Lin.) of America.—Nearly as large as the preceding, and scarcely less dangerous: it is beautifully spotted with rings more or less complete, and containing smaller spots [on a deeper ground-tint: the space included within the annulations of all the spotted *Cats* being deeper coloured than the rest of the body.] Black individuals sometimes occur, which have the spots more intense, and visible only at particular angles, [the fur of the spots differing in texture: the same has been observed of the *Tiger* and *Leopard*, and albino individuals of the former have likewise been noticed. *Jaguars* also differ much one from another].

The *Panther* (*F. pardus*, Lin.: *Pardalis* of the ancients).—[Covered with annular series of irregular small spots.] It is widely spread over Africa, the hottest region of Asia, and also the Indian archipelago.

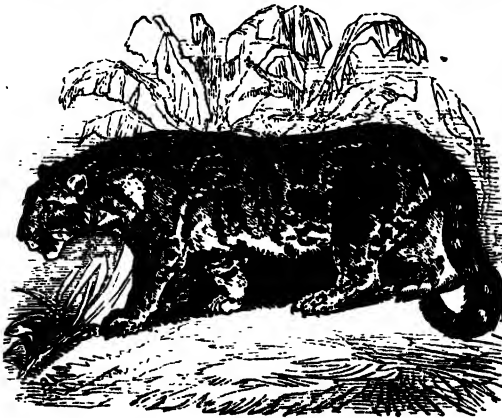


Fig. 33.—Tiger-cat of Sumatra.

The *Leopard* (*F. leopardus*, Lin.).—[Very like the *Panther*, but with the markings less broken into small spots: it varies, however, considerably, and the two sides of the same animal do not always resemble: from Asia and Africa.] These two species are smaller than the American *Jaguar* [and are very doubtfully separable from each other.

The *Ounce* of *Buffon* (*F. uncia*, Gm.) is a long-haired mountain *Cat*, as large as a *Leopard*, with tail longer than the body: also similarly spotted, but more obscurely, and on a paler ground-tint. It inhabits the Asiatic mountains, and a fine specimen of it has lately been deposited in the British Museum.

Of the other spotted *Cats*, may be mentioned the *F. chalybeata*, Herm., from the north of India; and *F. viverrina*, Ben., from Sumatra\*: also the *Rymau-dyan* (Fig. 33), or gigantic *Tiger-cat* of Sumatra (*F. macrosceltes*), and the nearly allied but smaller *Marbled Cat* (*F. marmorata*), from the same locality, which are remarkable for length of tail. The *Ocelot* of South America (*F. pardalis*,

\* Notwithstanding its name, this species presents no real approach to *Piveria*: its cranium, for instance, being strictly that of a *Felis*.

Lin.), twice the size of a large domestic Cat, and comparatively lower on the legs, is marked somewhat like the Jaguar, but with a tendency to a linking of the spots into longitudinal bands, more or less observable in different individuals.\* *F. Sumatrensis* and *Bengalensis* are not larger than a House-cat, but coloured like the foregoing; though individuals commonly occur of the same greyish ground-tint as the majority of the smaller species. A beautiful European Cat, with the markings of the Leopard group, is the *F. servatus*; Otter, which inhabits the mountains of Spain; its tail, however, is short, as in the following. There are many others].

Lynxes are short-tailed Cats, with mostly pencil-tufts to their ears, and fur generally spotted more or less distinctly; those of cold countries have the fur long.



Fig. 34.—*Felis Lynx*.

mobile tail: it inhabits Africa. Allied to it is the Chat (F. *silvestris*), a native of South America.

Approaching the domestic Cat in size, colour, and markings, are also numerous species, among which the native Cat of Britain (fig. 35) may be particularized, distinguished by its tail not tapering as in the tame Cat; it is also larger, but with much shorter intestinal canal, though it is probable that the length of intestine in the common Cat may have been gradually induced by long-continued habituation to a less carnivorous regimen, operating through many successive generations. The domestic Cat is referred by Temminck to his *F. maniculata*, a species wild in Egypt; but is probably a mingled race, derived from several distinct wild stocks: our author, in his last edition, referred it to the European Wild Cat, but subsequently retracted his opinion: the Angora variety

of it is perhaps the most remarkable, being covered with long silky hair. Of the spotless species, may be mentioned]



Fig. 35.—Wild Cat.

less dark, and rather low on the legs: and there is a deep reddish-brown Cat in India, scarcely larger than the

The Cougar, Puma, or pretended Lion of America (*F. concolor*, Lin.) (Fig. 36).—Red [silvery or greyish-red], with small spots of a slightly deeper colour, which are not easily perceived [nor always present in the adults, and a small black tuft at the end of the tail. Size nearly that of a Leopard], from both Americas, where it preys on Sheep, Deer, &c. [and has been known, though very rarely, to attack mankind. An allied species, redder, and with shorter tail, exclusively from South America, is known as *F. unicolor*; and there is a small species also very similar, the Fera of Azzara, the tail of which is not tufted. The Jaguarondi is another from the same locality, of medium size, altogether of a blackish-brown, more or

\* As a warning against relying too much upon the proverbially uncertain temper of these eminently carnivorous animals, may be mentioned a fact which occurred not long ago in France. A gentleman had succeeded in taming an Ocelot, which for three years enjoyed the range of his house and garden as freely as a domestic Cat, appearing thoroughly reclaimed. One evening, however, at the bedside, when a child of three years old was playing with it, as it had often done before, the animal, being irritated, seized the infant by the throat, and killed it before assistance could be rendered. An instance has occurred in this country of a babe being attacked by a tame Ferret. The Domestic Cat is undoubtedly more susceptible of attachment than it has been generally described; and it is surprising to perceive how patiently it bears the rough handling of children. We have seen it hail the return of persons it knew with as lively joy as

any animal could well testify, and this in the case of individuals who had never fed it: but it is understood, with what general truth may perhaps be questioned, that while the Dog will mourn and even pine to death over the body of its master, the Cat feels no compunction in making it its prey: It is needless to observe, however, that the intellect of the Cat is very much inferior to that of the Dog, on which account some allowance may be granted.

With respect to the Domestic Cat, also, another consideration may be borne in mind, which is, that there can be little doubt that its nature has been considerably modified by domestication, which has gradually rendered it less exclusively carnivorous than its wild congeners. It is even remarkable that instances of the rapacity of this animal towards young children are not of frequent occurrence.—Ed.

domestic, named *F. Temminckii*: *F. planiceps* approximates the last, but is smaller, with some markings on the head, and is remarkable for its complete bony orbits.]

We might place as a separate subgenus [*Ocellarius*, Blainv. ?] a species which has the head rounder and shorter, and the talaria of which are not retractile [a statement which is unvarranted by fact], the Chetab, or Hunting Leopard (*F. jubata*, Schreb.): size of a Leopard, but longer-bodied, and stands higher; of a pale fulvous, with tolerably uniform small black spots, a black streak reaching from the eye to the angle of the mouth, and tail annulated at the end. The disposition of this animal is mild and docile. [From Asia and Africa, but apparently not specifically the same on the two continents.]

The DIGITIGRADA of Cuvier, exclusive of the semi-plantigrade genera which have no cecum, divide primarily into, first, the Canine group, or the Dogs and Foxes, which is the most distinctly separated by anatomical characters; the remainder are all much more nearly allied, but we may venture to detach the Feline animals or Cats: the rest may all be included in the Viverrine section, to which the Hyenas strictly appertain; a varied, but quite natural assemblage, exclusively confined in its distribution to the eastern continent, and scarcely extending beyond the tropics; whereas the former groups are generally diffused, with the exception of Australia and the remote oceanic islands. Of the Viverrine animals, the most definitely characterized subdivision is that of the Mangoustes and subordinate sections: the Genets scarcely differ from the Cats except in the prolongation of the muzzle; and the Hyena group is so nearly related to the Civets that it does not appear to be separable on physiological characters.]



Fig. 35.—The Puma

#### THE AMPHIBIA [PINNIGRADA, Blain.]—

Compose the third and last of the minor tribes into which we divide the CARNIVORA. Their feet are so short and so enveloped in the skin, that, upon land, they only serve to crawl with\*; but, as the intervals between their toes are occupied by membranes, they form excellent oars: hence these animals pass the greater portion of their lives in the water, which they only quit to bask in the sunshine, and to suckle their young. Their lengthened body; their very moveable spine, provided with muscles which strongly flex it; their narrow pelvis; their short close fur, setting flat upon the skin; all combine to render them able swimmers, and the details of their anatomy confirm these first indications. [As in the Dugong, the Cetacea, and other large aquatic Mammalia, their bones are light and spongy, more particularly in the larger species.] Only two genera have as yet been distinguished, the Seals and the Morses.

#### THE SEALS (*Phoca*, Lin.)—

Have six or four incisors, above, four or only two below, pointed canines, and grinders to the number of twenty, twenty-two, or twenty-four [that is to say, two, in the complete series, posterior to the representative of the carnivorous tooth], all of them trenchant or conical, without any tuberculous portion: five toes to each foot, the anterior successively shortening from the thumb; whereas,

\* It is only when clambering that the Seal employs its feet on land: it wriggles along, upon the ground, by the action of the abdominal muscles.—Ed.

## MAMMALIA.

in the hind feet, the outer and inner toes are the longest, and the intermediate comparatively short. Their fore-feet are enveloped in the integuments of the body as far as the wrist, the hinder almost to the heel; between the latter is a short tail. The head of a Seal resembles that of a Dog; and they have the same intelligence and mild and expressive physiognomy. They are easily tamed, and become much attached to their feeder. The tongue is smooth, and notched at the end, their stomach simple, cœcum short, intestinal canal long, and tolerably regular. These animals subsist on fish, which they always devour in the water, and are enabled to close their nostrils when diving, by means of a sort of valve. As they remain long below the surface, it was supposed that the *foramen ovale* continued open as in a fœtus, which is not the case: they have a large venous cavity, however, in their liver, which assists them in diving, by rendering respiration less necessary to the motion of the blood. The latter is very abundant and very dark.

Analogous to *Calocephala*, THE SEALS, (properly so called, or without external ears),—

Have the incisors pointed; all their toes enjoy a certain degree of motion, and are terminated by pointed nails placed on the edge of the connecting membrane.

They may be divided according to the number of their incisors. In

*Calocephala*, F. Cuv. [*Phoca*, as restricted],—

There are six above and four below. [The cheek-teeth have more than one root; and besides the main cutting point, there is on each an anterior smaller one, and two posterior. The brain is in this division amply developed, and the intelligence proportionate.]

The common Seal (*Ph. vitulina*, Lin.; *Ph. littorea*, Thiem.)—Common on the coast of Europe in vast herds, and

extending far to the north. The European seas, however, contain several *Phocæ*, which have been long confounded, some of which are perhaps varieties of the others; as *Ph. hispida*, Schreb.; *Ph. annellata*, Nills.; *Ph. fetida*, Fabr., &c. [Those of the British islands much require elucidation.] A species more easily recognized is

The Harp Seal (*Ph. groenlandica* and *oceanica*, Auct.), from the whole north of the globe. [Remarkable for the difference in marking between the adult male (fig. 37) and the female and young: length five feet. It pertains to the British fauna, as does also the next species, according to report, for which the *Halicharus griseus*, however, has been generally mistaken.]

Bearded Seal (*Ph. barbata*, Fabr.), a northern species, surpassing all the preceding ones in size, which is from seven to eight feet. Its moustaches are thicker and stronger than in the others. [Several more are known from the northern hemisphere.]



Fig. 37.—Greenland Seal.

THE STERNINCKS (*Stenorhynchus*, F. Cuv.)—

Possess four incisors to each jaw, and cheek-teeth deeply notched into three points (fig. 38), [but with single roots: the muzzle slender and much elongated; and very small claws].

One only is known (*Ph. leptonyx*, Bl.), from the Austral seas: size of the Bearded Seal. [An allied species constitutes

THE LEPTONYX (*Leptonyx*, Gray)—

The grinders of which are bluntly three-lobed, the muzzle broad and rounded, and hind feet clawless.

*Otaria Weddellii*, Lesson.—Also from the South Seas].

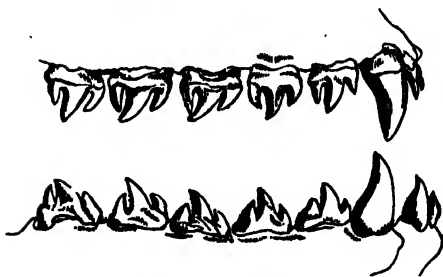


Fig. 38.—Teeth of Sterninck

## CAENARIA.

THE MINK (*Mustela, F. Cuv.*)—

Also possesses four incisors to each jaw; but the grinders form obtuse cones, with a slightly process before and behind. There is one in the Mediterranean.

*Ph. mowchus*, Gm., from ten to twelve feet in length. It is particularly found among the Grecian and Adriatic Isles, and was probably the species best known to the ancients.

[THE HALKETS (*Halicharus*, Nilsson).

Grinding teeth of the upper jaw simple; those of the lower with an inconspicuous tubercle before and behind. Muzzle deep and obliquely truncated: the head flat, and brain comparatively very small.

*H. gryphus*, Nils., a species nearly as large as the Bearded Seal, inhabits the Baltic and British seas, where it would seem to be not uncommon. Its intelligence has been observed to be very inferior to that of the true *Phoca*.]

THE HOODCAP (*Stenmatopus*, F. Cuv.).

Four superior, and two inferior incisors; the grinders compressed and slightly three-lobed, supported by thick roots.

*Ph. cristata*, Gm.; *Ph. leonina*, Fabr.—A species attaining a length of seven or eight feet, with loose skin upon the head, which can be inflated into a sort of cowl, and is drawn over the eyes when the animal is menaced, at which time the nostrils also are puffed out like bladders. From the Arctic Ocean.

Finally,

THE MYROUNGAS (*Macrorhinus*, F. Cuv.; [*Cystophora*, Nilsson,])—

Possess, with the incisors of the preceding, obtuse conical molars (fig. 39) [but massive canines], and muzzle lengthened into a short moveable proboscis. The largest known Seal is of this subgenus; the



Fig. 39.—Teeth of Myrounga.

*Ph. leonina*, Lin.—Twenty to twenty-four feet in length [sometimes thirty, according to English measure, and of great proportionate bulk]. Brown, the muzzle of the male terminated by a wrinkled snout, which becomes inflated when the animal is angry. It is common in the southern latitudes of the Pacific Ocean, and of great request for the quantity of very superior oil with which it abounds.

Those with external ears,

THE OTARIES (*Otaria*, Peron).—

Are worthy of being formed into a separate genus, inasmuch as, besides the projecting auditory conch, the four middle upper incisors have a double cutting edge (a structure not hitherto remarked in any other animal); the exterior are simple and very small, and the four inferior forked: the molars are all simply conical. The toes of their anterior swimming-paws [which are placed far backward] are almost immoveable; and the membrane of their hind feet is prolonged into a flap beyond each toe: all the nails are thin and flat.

*Ph. jubata*, Gm. (*Sea Lion* of Steller, Pernatty, &c., but not of Anson, which refers to the Myrounga; the latter being also the *Sea Wolf* of Pernatty). From fifteen to twenty feet [French], and more, in length: the neck of the male covered with more frizzled and thickly-set hairs than those on the other parts of the body. From the South Pacific.

[The Falkland Otary, or *Fur Seal* of commerce (*C. Falklandia*, Desm.).—Remarkable for the great disproportionate size of the sexes (if, indeed, the same does not apply to all its congeners); the full-grown male, according to Weddell, measuring 6 ft. 9 inch.; the female only 3½ feet. It is polygamous, in the proportion of one male to about twenty females. The fur is an esteemed article of commerce; and so abundant was the species formerly in various localities, that for a period of fifty years, not less than 1,200,000 skins were annually obtained from a single island].



Fig. 40.—The Urial.

The Ural (*Ph. ursina*, Gm. [*Arctocephalus ursinus*, F. Cuv. fig. 40].)—Eight feet long, no mane, varying from brown to whitish. From the north of the Pacific Ocean.

#### THE MORSE (*Tricheus*, Lin.)—

Resembles the Seals in the general form of its body and limbs, but differs considerably from them in the head and teeth. The lower jaw has neither incisors nor canines, and is compressed anteriorly to pass between two enormous canines or tusks which issue from the upper one, and which are directed downwards, attaining sometimes a length of two feet, with proportionate thickness. The magnitude of the sockets requisite for holding such enormous canines raises up the whole front of the upper jaw, so as to form a thick bulging muzzle, the nostrils opening upwards, instead of being terminal. The molars are all short cylinders, obliquely truncated. There are four [or five] on each side above and below; but at a certain age, two of the upper ones fall out. Between the canines are two incisors similar to the molars, which the majority of observers have overlooked, as they are not fixed in the intermaxillary bones; and between these again, in young individuals, are two pointed and small ones.

The stomach and intestines of the Morse are nearly similar to those of the Seal; and it appears that they subsist on fuci as well as on animal substances.

One species only has been ascertained, the Morse or Walrus (*Tr. rosmarus*, L.); an inhabitant of all parts of the Arctic seas, exceeding the largest Bull in bulk; it attains a length of twenty feet, and is covered with short yellowish hair. This animal is much sought for on account of its oil and tusks; the ivory of which, though coarse-grained, is employed in the arts. The skin makes excellent coach-braces. [A strange assertion originated with Sir E. Home, that the feet of the Morse possess suckers, by which it is enabled to ascend perpendicular ice-bergs. There is no foundation for this statement.

It is difficult to intercalate the *Amphibia* in the series of *Carnivora*, and to determine to what extent their peculiarities should be regarded as adaptive modifications, based on the rudimental structure of the whole order.

At the head of the *Carnivora* we prefer to place the Dogs or *Canidæ*, followed by the *Viverridæ* and *Felidæ*: the Seals or *Phocidæ* might, we conceive, next range with less impropriety than elsewhere: and after them the *Mustelidæ*, and *Ursidæ*; then, finally, the *Insectivora*, which the author ranks as equivalent to all the foregoing. The *Cheiroptera*, or Bats, we deem to be subordinate rather to the preceding order.

Remains of nearly all the principal genera and some additional ones have been found, more or less abundantly, in the tertiary strata, or deposits overlying the chalk, but not in beds of anterior formation.]

### THE FOURTH ORDER OF MAMMALIANS.—

#### MARSUPIATA,—

(Or that of the Pouched Animals.)—

With which we formerly terminated the *CARNARIA*, as a fourth family of that great ordinal division, presents so many singularities in the economy of its members, that we are induced to separate and elevate it to its present position; the more particularly, as we observe in it a sort of representation of three very different orders.

The first of all their peculiarities is the premature production of their young, which are born in a state of developement scarcely comparable to that of an ordinary foetus a few days after conception. Incapable of motion, and barely exhibiting the rudiments of limbs and



other external organs, these minute offspring attach themselves to the teats of their mother, and remain fixed there until they have acquired a degree of development analogous to that in which other animals are born. The skin of the abdomen is almost always so disposed around the mammae as to form a pouch, in which these imperfect young are preserved as in a second uterus; and into which, long after they can walk, they retire for shelter on the apprehension of danger. Two peculiar bones attached to the pubis, and interposed between the muscles of the abdomen, support the pouch, [and prevent inconvenient pressure of the young, when grown, upon the bowels.] These bones are also found in the male, and even in those species in which the fold that forms the pouch is scarcely visible.

The matrix of the animals of this order does not open by a single orifice into the extremity of the vagina, but communicates with this canal by two bent lateral tubes. The premature birth of the young appears to depend on this singular organization. The scrotum of the male, contrary to what obtains in other quadrupeds, hangs before the penis, which at rest is directed backwards.

Another peculiarity of the *Marsupia* is, that, notwithstanding a general resemblance of the species to each other, so striking that they were all long included in one genus, they differ so much in the teeth, the digestive organs, and the feet, that if we rigidly adhered to these characters, it would be necessary to separate them into distinct orders. They carry us by insensible gradations from the *Carnaria* to the *Rodentia*\*, and there are even some animals which have the pelvis furnished with similar bones; but which, being destitute of incisors and, even of any sort of teeth, have been approximated to the *Edentata*, where, in fact, we shall leave them, under the name of *Monotremata*. [The latter are now more properly included as a second order of the same superior division of Mammalia which contains the *Marsupia*, by the general consent of physiologists.]

In brief, it may be stated that the *Marsupia* form a distinct class, parallel to that of ordinary quadrupeds, and divisible into similar orders; so that, if we were to arrange these two classes into even columns, the Opossums, Dasyures, and Bandicoots, would be opposed to the insectivorous *Carnaria*, such as the Tenrecs and Moles; the Phalangiers and Potoroos to the Urchins and Shrews; while the Kangaroos, properly so called, could not well be compared with any other genus; but the Wombat should be placed opposite the *Rodentia*. Lastly, if we were to consider the bones of the pouch only [commonly designated *marsupial* bones], and regard as marsupial all animals which possess them, the Platypuses and Echidnas might compose a group parallel to the *Edentata*.

Linnaeus ranged all the species which he knew under his genus *Didelphis*, signifying *double matrix*. The pouch is indeed in some respects a second one.

[The *Marsupia*, together with the *Monotremata*, is now generally regarded as a distinct subclass, *Ovovivipara*, equivalent to the rest of the Mammalia. Its members are lower in their organization than any other mammiferous animals, approximating the oviparous type (and particularly Reptiles), in sundry details of their organization. The hemispheres of the brain, for instance, (which is much reduced in size,) are not united by a *corpus callosum*; and they are observed to be very defective in intelligence, as is indicated by their physiognomy†: the blood also is returned to the heart by two principal veins, as in Birds and Reptiles; and the sutures of the skull never become united. In short, they hold an analogous relation towards other Mammalia, to that which the *Batrachia* present to all other Reptiles. Their incisor teeth frequently exceed six in number, which is the maximum throughout the rest of the class,—another indication of their inferiority.

The geographic range of the *Marsupia*, with the exception of the Opossum group peculiar to America, is at present almost confined to Australia and the neighbouring coun-

\* Only upon the supposition that the gnawing teeth of the *Rodentia* are modified incisors, which is more than doubtful.—En.

† A curious illustration of this inferiority on the part of the *Marsupia*

is afforded by their turning to bite the stick with which they are smitten, rather than the hand that guides it.



tries, where they constitute, very nearly indeed, the only mammiferous animals; but fossil remains of them occur, sparingly, in the ancient *secondary* deposits of Europe, where hitherto no higher Mammalia have been detected. Consequently, the *Marsupialia* would appear to have been much earlier introduced upon our planet; a further indication, if not of their inferiority, at least of their intrinsical separateness as a group: there is reason also to suspect that at former epochs they were much more numerous, as well as generally diffused, than at present.\*]

The first subdivision of them is distinguished by long canines, and small incisors to each jaw; the back molars are beset with pointed tubercles, and the general character of the teeth is the same as in the *Insectivora*, which these animals entirely resemble in their regimen.

THE OPOSSUMS (*Didelphis*, Lin.)—

Which of all the *Marsupialia* have been the longest known, compose a genus peculiar to America. They have ten incisors above, and eight below; three anterior compressed molars, and four sharply tuberculated back molars, the superior of which are triangular, the inferior oblong: so that, with the four canines, they have in all fifty teeth, a number greater than has as yet been observed in any other quadruped.† Their tongue is bristled, and the tail prehensile and in part naked; the hinder thumb is long and effectively opposable to the four other digits, whence the name *Pedimanus* has been applied to these animals; it is not furnished with a nail. Their extremely wide mouth, and large naked ears, give them a peculiar physiognomy. The *glans penis* is bifurcated. They are fetid and nocturnal animals, whose gait is slow; nestle upon trees, and there pursue birds, insects, &c., without rejecting fruit: their stomach is small and simple, and the cœcum moderate and without enlargements.

The females of certain species have a deep pouch, wherein are placed their teats, and in which the young are inclosed.



Fig. 41.—Common Opossum.

The Common Opossum (*D. virginiana*, Pen. (fig. 41.)—Nearly the size of a Cat; fur, a mixture of black and white; it inhabits the whole of America, enters the villages at night, and attacks poultry, devouring their eggs, &c. The young at birth, sometimes sixteen in number, weigh only a grain each. Although blind and nearly shapeless, they find the nipple by instinct, and adhere until they have attained the size of a Mouse, which happens about the fiftieth day, at which epoch they open their eyes. They continue to return to the pouch until they are as large as Rats. The term of uterine gestation is only twenty-six days. [Several others are known; one of which] the Crab-eating Opossum (*D. cancer-vorus*), frequents the marshes of the sea-coast, where it feeds chiefly upon crabs.

Other species possess no pouch, but merely a vestige of it, or fold of skin on each side of the belly. They habitually carry their young on their backs, the tails of the latter being entwined round that of the mother.

[A considerable number are known, from South America.]

THE YAPACH (*Cheironectes*, Illig.)—

[Is merely an aquatic Opossum, with semi-palmate toes.]

\* Since writing the above, Prof. Blainville has published an elaborate Essay on the reputed *Marsupialia* of the secondary deposits, wherein he advances the opinion that these celebrated fossil remains appertain rather to reptiles of a higher organization than any now existing. M. Valenciennes and Prof. Owen have subsequently advocated the currently received opinion; while the first-named naturalist has been supported by Dr. Grant, who long previously had

entertained the same idea. The question still remains *sub judice*; and it even appears that the objections to either solution of the difficulty are more weighty than the arguments in its favour.

† There are fifty-two teeth in the newly-discovered *Myrmecobius*. The multiplication of the teeth in the *Cretaceus* is on a different principle.—Ed.

The Yapach (*Did. palmata*, Geof. ; *Lutra memina*, Bodd, fig. 42) frequents the rivers of Guiana.



Fig. 42.—The Yapach.

All the other Marsupials inhabit eastern countries, and especially New Holland ; a land of which the mammiferous population seems even to consist principally of animals of this group.

[The three next genera, and probably the fourth, possess no cæcum.]

#### THE THYLACINES (*Thylacinus*, Tem.)—

Are the largest of this first division : they are distinguished from the Opossums by the hind-feet having no thumb, by a hairy and not prehensile tail, and two incisors less to each jaw ; their molars are of the same number. They have accordingly forty-six teeth ; but the external edge of the three large ones is projecting and

trenchant, almost like the carnivorous tooth of a Dog : their ears are hairy, and of middle size.

But one [living] species is known, a native of Van Diemen's Land.—Size that of a [small] Wolf, but lower on the legs ; of a greyish colour, barred with black across the crupper (*Did. cynocephala*, Harris). It is very carnivorous, and pursues all small quadrupeds. [This animal does not fish, as has been stated ; nor is its tail compressed : it is principally nocturnal, and is called *Tiger* and *Hyæna* in its native island.] A fossil species of Thylacine has been found in the gypsum quarries of Paris.

#### THE PHASCOGALES (*Phascogale*, Tem.)—

Have the same number of teeth as the Thylacines ; but their middle incisors are longer than the others, and their back molars more sharply tuberculated, in which respect they rather approximate the Opossums. They are also allied to them by their small size ; the tail, however, is not prehensile : their posterior thumbs, though very short, are still distinctly apparent.

[Four species are now known, varying from the size of a Rat to that of a Mouse : they inhabit New Holland and Van Diemen's Land, where they live on trees, and pursue insects.]

#### THE DASYURES (*Dasyurus*, Geof.)—

Have two incisors and four grinders in each jaw less than the Opossums, so that they have only forty-two teeth ; and their tail, everywhere covered with long hairs, is not prehensile. The hinder thumb is reduced to a mere tubercle, or even quite disappears, [as in the Thylacine]. They inhabit New Holland, and subsist on insects and dead carcasses ; they even penetrate into houses, where their voracity is very inconvenient. Their mouth is not so wide\*, and the muzzle [much] less pointed, than in the Opossums ; their ears also are shorter, and hairy. They do not ascend trees.

The Ursine Dasyure (*Did. ursina*, Harris).—Long coarse black hairs, with some white markings ; the tail half as long as the body, almost naked underneath. Inhabits the north of Van Diemen's Land, and is nearly the size of a Badger. [This species, which is of common occurrence, is designated in Van Diemen's Land *the Devil* : it is nocturnal, and very destructive to Sheep, of a fierce disposition, bites severely, and is a match for an ordinary Dog : in common with the rest of its tribe, including the Thylacary, it often sits on its haunches, and cleans its head with its fore-paws.]

The long-tailed Dasyure (*Das. macrourus*, Geof.)—Size of a Cat, with the tail as long as the body ; fur brown, spotted with white both on the body and tail. The tubercle of the thumb is still well marked in this species, but in the following it can no more be seen.

Mauge's Dasyure (*Das. Maugii*, Geof.)—Rather smaller than the preceding, of an olive colour, spotted with white both on the body and tail : and lastly, *Did. viverrina*, Shaw ; which is black, spotted with white, and no spots on the tail ; a third less than the first. [These are still the only ascertained species, though it is probable that others remain confounded. The last is termed *Wild Cat* in Van Diemen's Land, and is very destructive to poultry, of which it only sucks the blood. These animals apply the entire sole of the hind-foot to the ground when standing,

#### THE MYRMECOBÆ (*Myrmecobius*, Waterh.)—

Has the greatest number of teeth of any known marsupial, fifty-two in all ; namely, eight upper and

\* I have been much astonished on witnessing the amazingly wide gape of the Ursine Dasyure.—Eo.

six inferior incisors, and behind the canines four compressed molars in each jaw, and finally four small molars above, and five below, the latter pectinated internally in consequence of the irregularity of attrition; the canine of the lower jaw is much incurved. The form of this animal is similar to that of a Squirrel, but with a long and pointed muzzle, as in the Banxring; it has no thumb to the hind-foot.

The Banded Myrmecobite (*M. fasciata*, Waterh.)—Size of a Rat, and barred on the crupper similarly to the Thylacine, but with white bands on a reddish ground tint. The only specimens at present known were procured at some river settlement, Australia. This animal has been supposed to present the nearest living approach to the fossil *Thylacotherium* of the secondary lias.]

#### THE BANDICOOTS (*Perameles*, Geof.; *Thalassidroma*, Illig.)—

Have the hinder thumb short, as in the first Dasyures, and the two following toes joined by the skin as far as the claws; the thumb and little toe of their fore-feet are reduced to simple tubercles, so that there seem to be only three toes: the superior incisive teeth are ten in number, the most hindward pointed, and widely separated from the rest; below there are only six, [the posterior bilobate]; but their molars are the same as in the Opossums, [though less angular internally]. Their tail is hairy, and not prehensile. They inhabit Australia. The great claws of their fore-feet, almost straight, announce the habit of digging into the ground, and their rather long hind-feet that their gait is rapid. [Their cæcum is of middle size, as in the Opossums, to which they are approximated by Prof. Owen.]

The Long-nosed Bandicoot (*P. nasutus*, Geof.)—Muzzle very much elongated; the ears pointed; fur a greyish brown. It resembles, at the first glance, a Tenrec. The *P. obesula*, Geof., is not so authentic. [The latter is now well established, as also another, *P. gunnii*, from Van Diemen's Land, which is very generally diffused throughout that island; it lives principally on bulbs, but also on insects. Two or three more have been indicated, one of which, *P. lagotis*, Reid, is ranged by Prof. Owen as

#### THE PHILANDER (*Thalacomys*, Owen),—

The superior hindward incisor of which is close to the others, and the muzzle very long, and abruptly attenuated: auditory bullæ remarkably large, and divided posteriorly. The ears long, and the tail also long and bushy.

The only known species (*Per. lagotis*, Reid)—is a nimble-looking and handsome animal; greyish, and as large as the common Opossum. From New South Wales.]

In the second subdivision of Marsupials, there are two large and long incisors in the lower jaw, with pointed and trenchant edges sloping forwards, and six corresponding teeth in the upper one. The superior canines are still long and pointed; but those of the lower jaw are so small that they are often hidden in the gum: in the last subgenus there are even none below.

Their regimen is in great part frugivorous; hence their intestines, and particularly the cæcum, are much longer than in the Opossums. They have all a large thumb, so separated from the other digits that it seems directed backward as in Birds: it has no nail, and the two following fingers are joined by the skin as far as the last phalanx. It is from this circumstance that they have derived their name of

#### PHALANGERS (*Phalangiata*, Cuv.)

##### THE RESTRICTED PHALANGERS (*Balanitia*, Illig.)—

Have not the skin of the flank extended: they have on each jaw four back molars, all of which present individually four points, ranged in two rows; and before these a large one, conically compressed; also, between this and the upper canine, two small and pointed teeth, to which correspond the very small teeth below, of which we have spoken: their tail is always prehensile.

In some it is in great part scaly. They inhabit trees in the Molucca islands, where they feed on insects and fruit. At the sight of a man they suspend themselves by the tail; and if he gazes at them steadily for some time, they fall through lassitude. They diffuse an offensive odour, notwithstanding which their flesh is eaten.

Several species are known, of various size and colours, all of which are comprehended under the *Didelphis orientalis* of Linnaeus. [Those in which the tail is partly scaly are peculiar to the Molucca islands, and constitute the division *Cuscus* of some systematists. Five are enumerated by the author, who follows Temminck.]

In others, which have hitherto been found in New Holland only, the tail is hairy to the tip.

[The author enumerates three, to which four have since been added by Mr. Ogilby, and an eighth by M. Geoffroy. These animals keep in holes of trees till twilight, and for an hour or two after sunset are observed eating the leaves of the different *Eucalypti*; also, in retired places, those with the young shoots of fruit-trees. The *Ph. vulpina* is known as the *Brush-tailed Opossum* in Van Diemen's Land, and the *Ph. Cookii*, as the *Ring-tailed Opossum*.]

#### THE PETARISTAE (*Petaurus*, Shaw; *Phalangiata*, Illig).—

Have the skin of the flanks more or less extended between the legs, as in the *Colugo*, and *Taguans* among the *Modesta*, by which they are enabled to sustain themselves in the air for some seconds, and to make greater leaps. They have been found only in New Holland.

Some of the species still possess inferior canines, but extremely small. Their upper canines and the three first molars, both above and below, are very pointed; the back molars have each four points [the last excepted, in which there are but three]. M. Desmarest has named this division *Acrotatus*: [It possesses thirty-six teeth in all.]

The Pygmy Petarist (*Did. pigmea*, Shaw).—Of the colour and nearly the size of a Mouse; the hairs of the tail disposed very regularly on its two sides like the barbs of a feather.

Other species have no inferior canines, and the superior are very small. Their four back molars each present four points, but a little curved into a crescent, somewhat as observed in the *Ruminants*. Anteriorly, there are two above and one below, less complicated: this structure renders them still more frugivorous than any of the preceding. [Their teeth amount in all to thirty-four.]

The Great Petarist (*Did. petaurus*, Shaw; *P. taguanoides*, Desm.).—Resembles the *Taguau* and the *Colugo* in size: its fur is soft and thick, and the tail long and [not in those which I have seen] flattened: brown-black above, white underneath.

The *Scirine* Petarist (*Did. scireus*, Shaw).—Ash-coloured above, white beneath, and smaller than the preceding; a brown line commencing on the muzzle and continued along the back: the tail tufted, and as long as the body, its posterior portion black. From the islands near New Guinea. [It is abundant along the south coast of New Holland. The teeth are forty in number, and exhibit considerable modification; hence this animal has been made a separate division of the *Bellidae*, Waterh. There are but four true molars to each jaw, with comparatively blunt tubercles originally; three false molars and a middle-sized canine above, and four small flattened teeth below: the palate also is in this group perfect, whereas it is not so in the two others. Four or five species are known to possess these characters.]

The remainder appertain to the same minimum group as *P. taguanoides*.]

Our third subdivision possesses the incisors and superior canines of the preceding. The two toes of the hind-foot are also similarly united; but the posterior thumbs and inferior canines are wanting. It contains but a single genus,

#### THE POTOROO (*Hypsigrymnus*, Illig).—

Which are the last animals of this family that retain any trace of the general character of the *Carnaria*. Their teeth are nearly the same as in the *Phalangera*, and they still have pointed canines above [which all but disappear in one species]. Their two middle upper incisors are longer than the rest, and pointed; the two inferior ones project forwards. They have anteriorly a long trenchant and denticulated molar, followed by four others, each with four blunt tubercles. What particularly distinguishes these animals, however, is their hind legs, which are very much longer in proportion than their fore ones, that have no thumbs, and the two first toes of which are joined as far as the nail; so that, at a first glance, it seems as though there were but three toes, the middle one having two nails. They often hop on their hind-feet, at which time they make use of their long and strong tail to support themselves. They have accordingly the form and habits of the *Kangaroos*, from which they only differ in possessing the superior canine. Their regimen is frugivorous, and the stomach large, divided into two sacs, and possessing several inflexions; but their cæcum is moderate and rounded.

Only one species is known, the size of a small Rabbit, and of a mouse-grey colour, which is termed the *Kangaroo-rat* (*Macropus minor*, Shaw.) [Five or six others have since been discovered, two of which, inhabiting New Guinea, are remarkable for their arboreal habits; in reference to which their structure is slightly modified, the limbs being less unequal, and the great nails of their hind-feet curved; they do not, however, essentially differ from the others. One species is common in the interior of Van Diemen's Land.]

The fourth subdivision differs only from the third in having no canines whatever.

#### THE KANGAROOS, (*Macropus*, Shaw; *Halmaturus*, Illig).—

In which all the characters occur that we have assigned to the preceding genus, except that the upper

## MAMMALIA.

canines are wanting, and the middle incisors do not project beyond the others. The unequal size of the limbs is even more remarkable, so that they advance on all fours with difficulty and slowly, but make immense leaps on their hind-feet, the great nail of which (almost in the shape of a hoof) serves them likewise for defence, as, by supporting themselves on one foot and their enormous tail, they can inflict a severe blow with that which is at liberty.\* They are very gentle, herbivorous animals, their grinders presenting only transverse ridges: they possess five in all, of which the anterior are more or less trenchant, and fall with age, so that older individuals have often only three. Their stomach is formed of two elongated sacs, that are inflated at several places like a colon: the cæcum also is large and inflated. The radius allows a complete rotation of the fore-arm.

The penis in these two genera is not bifurcated; but the female organs are similar to those of other *Marsupialia*.



Fig. 43.—Great Kangaroo.

small canines. It comprehends but one genus,

*THE KOALA (Koala, Cuv.; Lipurus, Goldf.; Phascolarctos*†, Blainv.),—

Which presents a short, stout body, and short legs, without any [or rather with a short] tail: their anterior toes, five in number, separate into two groups for prehension, the thumb and index antagonizing with the other three. On the hind-feet there is no thumb; and the first two toes are united as in the Phalangiers and Kangaroos. [There are five molars in each jaw, square, with four tubercles each, excepting the first. This animal is essentially a Phalanger with a short tail.]

One only is known (*Lip. cinereus*, Goldfuss).—Of a greyish colour, which passes its life partly upon trees, and partly in burrows which it excavates at their foot (fig. 44.) The female carries her young for a long time on her back.

Finally, our sixth division of the Marsupial animals, consisting of



Fig. 44.—Koala.

*THE WOMBAT (Phascalomys, Geof.; [Amblyotis, Bass]),—*

Comprehends a true Rodent according to the teeth and intestines, which preserves its relationship with the *Carnaria* only in the mode of articulation of its lower jaw; and which, in a rigorous system, it

\* A Kangaroo will hug a Dog with its fore-paws, while it kicks and rips up the belly with its hind-foot.—En.

† It appears rather that the animals of this genus are not strictly gregarious, but collect accidentally at the scattered feeding places.

They lodge during the day among high ferns, and feed chiefly by night, or in the evening and morning; but are very sharp-sighted during the day.—En.

‡ This term is generally adopted.—En.

would therefore be necessary to rank among the *Rodentia*. We should even have placed it there, had we not been gradually led to it by an uninterrupted series from the Opossums to the *Phalangers*, thence to the Kangaroos, and from the Kangaroos to the Wombat.\* Their reproductive organs are entirely similar to those of other *Marsupiala*.

They are sluggish animals, with large flat heads, and bodies that appear as if crushed. They are without a tail; have five nails on each of the fore-feet, and four, with a small tubercle in place of a thumb, on each of the hind ones, all very long and adapted for burrowing. Their gait is remarkably slow. They have two long incisors to each jaw, almost similar to those of the *Rodentia*, [but which oppose flat surfaces to each other, and not chisel-like edges, as in the latter]; and their grinders have each two transverse ridges.

They subsist on herbage, and have a large and pear-formed stomach, and short and wide cœcum, furnished (like that of Man and the Ourang-outang) with a vermiform appendage. The penis is forked, as in the Opossums.

One species only is known (*Did. ursina*, Shaw); of the size of a Badger; the fur abundant, and of a more or less yellowish-brown. It is found in Van Diemen's Land, where it lives in its burrow; and breeds readily in confinement. The flesh is said to be excellent. [The skin of this animal is remarkably thick, and curiously attached to the hip-bones: its eyes are unusually small. When attacked, it grunts like a Pig; and is found at various elevations, burrowing in the forests and low grounds, and retiring to crevices in the upper. To the colonists, it is generally known as the *Badger*.

The *Marsupiala* are distributed by Prof. Owen, in conformity with the structure of their digestive organs, as follows:—

1. The cœcum altogether absent.—*Thylacynus*, *Dasyurus*, *Phascogale*, and probably *Myrmecobius*.

2. With a small cœcum.—*Didelphis* and *Cheironectes*; *Perameles*, and probably *Thylacomys*.

3. Cœcum of large size.—*Phascolarctos*, *Phalangista*, *Petaurus*.

4. The stomach complicated.—*Macropus* and *Hypsiprymnus*.

5. Cœcum with a vermiform appendage.—*Phascalomys*.

This arrangement appears to be perfectly in accordance with the affinities of these animals: though, at the same time, it may be added that the Wombat (*Phascalomys*) might properly form a distinct order of *Ovoovivipera*.]

## THE FIFTH ORDER OF MAMMALIANS.

### RODENTIA.

We have just seen, in the *Phalangers*, canines so small, that we can hardly consider them as such. The nutriment of these animals, accordingly, is chiefly derived from the vegetable kingdom. Their intestines are long, and the cœcum simple; and the Kangaroos, which have no canines at all, subsist on vegetables only. The Wombat might commence that series of animals of which we are now about to speak, and which have a system of mastication even less complete.

Two large incisors in each jaw, separated from the molars by a wide interval, cannot well seize a living prey, or devour flesh. They are unable even to cut the aliment; but they serve to file, and by continued labour, to reduce it into small particles; in a word, to *gnaw* it: hence the name *Rodentia* applied to the animals of this order: it is thus that they suc-

\* This gradation is, however, more apparent than real, as regards the Wombat, which differs from all other *Marsupiala* in the persistence of the formative pulp of its teeth, which, in consequence, never cease growing at the base, as their crowns wear away by attrition.—Ed.

cessfully attack the hardest substances, frequently feeding on wood and the bark of trees. The better to accomplish this object, these incisors have enamel only in front, so that their posterior edges wearing away faster than the anterior, they are always naturally sloped [or chisel-like]. Their prismatic form causes them to grow from the root as fast as they wear away at the tip [their formative pulps being persistent]; and this tendency to increase in length is so powerful, that if either of them be lost or broken, its antagonist in the other jaw, being to oppose or comminute, becomes developed to a monstrous extent. The incisors are articulated by a longitudinal condyle, in such a way as to allow of no horizontal motion, except from back to front, and *vice versa*, as is requisite for the action of gnawing. The molars also have flat crowns, the enamelled eminences of which are always transversal, so as to be in opposition to the horizontal movement of the jaw, and better to assist in trituration.

The genera in which these eminences are simple lines, and the crown is very flat, are more exclusively frugivorous; those in which the eminences of the teeth are divided into blunt tubercles are omnivorous; while the small number of such as have no points more readily attack other animals, and approximate somewhat to the *Carnaria*.

The form of the body in the *Rodentia* is generally such, that the hinder parts of it exceed those of the front; so that [with the exception of a large South American group, including the Guinea-pig and its allies,] they rather leap than run. In some of them, this disproportion is even as excessive as in the Kangaroos.

The intestines of the *Rodentia* are very long; their stomach simple, or but little divided; and their cæcum often very voluminous, even more so than the stomach. In the subgenus *Myoxus*, however, this intestine is wanting.

Throughout the present group, the brain is almost smooth and without furrows: the orbits are never separated from the temporal fossæ†, which have but little depth: the eyes are directed sideways: the zygomatic arches, thin and curved below, announce the feebleness of the jaws; and the fore-arms have almost lost the power of rotation, their two bones being often united: in a word, the inferiority of these animals is perceptible in most of the details of their organization. Those genera, however, which have stronger clavicles, display a certain degree of address, and employ their fore-feet together to hold up food to the mouth: some of them even climb trees with facility.

[We have seen that in the true Lemurs the middle superior incisors are separated by a wide interval, which in the Colugos (*Galeopithecus*) is still more extended: in *Propithecus* of Mr. Bennett, on the contrary, the front pair are brought nearly contiguous, having more of the Monkey character than in other *Strepsirrhini*. The lower canines also, which are directed horizontally forward throughout that group, and approximated so as to leave little room for the intervening incisors, which are accordingly extremely narrow or compressed, are even more approximated in the *Propithecus*, so that one pair of the incisors is necessarily sacrificed; and hence the diminution of the interspace between the upper incisors. Now in this we may discern a slight approach to the rodent character of *Cheiromys*, in the loss of one pair of incisors. In the latter genus, the whole of the incisors disappear, the canines of both jaws occupying their site: precisely as in the true *Rodentia*, wherein also the incisors and not the canines or tusks are almost without exception obliterated, as is beautifully shown in the instance of the Hare, where true incisors exist posterior to the upper gnawing teeth: it will be observed that in all *Rodentia* the currently reputed incisors pass through the intermaxillaries; while the constant limitation of their number to two in each jaw, and the inviolable absence of any trace of other teeth in the ordinary position of canines, assist in confirming the opinion here decidedly entertained respecting the nature of what have been designated incisive teeth in these animals. It may be added that the *Marsupialia* do not, therefore, as

\* We have seen one of these upper teeth thus prolonged, and gradually curling round, so as to destroy the eye of a Rat.—Ed.

† They are so in *Cheironomys*, ranged by the author in this order.—Ed.



arranged by Cuvier, effect a transition in the rudimental character of their dentition from the *Carnivora* to the *Rodentia*; inasmuch as the *canines*, and not the incisors, disappear in them (as observable in *Hypsiprymnus*): the Wombat (*Phascalomys*), might indeed be thought, to present a solitary exception to this remark; but there is reason to believe that the gnawing teeth of this animal are modified incisors. Perhaps the nearest affinity of the *Rodentia* is with the Elephant, among the *Pachydermata*.]

Some of the *Rodentia* even,

#### THE SQUIRRELS (*Schurus*, Lin.).—

Which may be recognized by their very compressed lower incisors, and by their long bushy tail. Their fore-feet have only four toes, the hinder five: the site of the anterior thumb is however marked by a tubercle [and it is between these tubercles of the two fore-paws that the Squirrels and allied genera hold up their food to the mouth]. They have in all four grinders to each jaw, variously tuberculated, and a very small additional one above in front, which soon falls. Their head is large, the eyes prominent and lively. They are light and agile animals, which nestle on trees, and subsist upon their produce.

#### THE SQUIRRELS, properly so called (*Schurus*, Cuv.).—

Have the hairs on the tail directed laterally, so as to resemble a feather. There are numerous species on both continents.

The Common Squirrel (*Sc. vulgaris*, L.).—[Bright red in summer, with a dash of grey on the upper parts in winter, at which latter season the fur is much finer, and the ears are terminated with long hairs; the belly white.] One of the most beautiful is the

*Sc. maximus* and *macrourus*, a native of India.—Nearly the size of a Cat; above, black, the flanks and top of the head a beautiful bright maroon, the head, and all the under parts of the body, with the inside of the limbs, pale yellow; a maroon-coloured band behind the cheek. It inhabits the palms, and is extremely fond of the milk of the cocoa-nut.

There are several species in warm climates, remarkable for the longitudinal bands which adorn their fur. Such are the Palmist [which has been known to vary entirely black, or white, &c. Certain African species, inhabiting rocky situations, the tail of which is not bushy, but thinly covered with stiff appressed hairs, and somewhat tufted at the extremity, constitute the *Petromys* of Smith; and others, also from Africa, which are entirely covered with coarse rigid fur, the claws of which also are long and straight, adapted for burrowing only, compose the *Xerus*, Emp., and Ehr.; *Geosciurus*, Smith: many of the latter animals live together, in holes of the ground; subsisting mainly on roots, for which they scratch up the soil. *Sc. capensis*, Thunberg, is an example of this form.]

It is probable that we shall have to separate from the Squirrels certain species that have cheek-pouches, like the Hamsters, and which retreat into subterraneous holes. They are

#### THE GROUND-SQUIRRELS (*Tamias*, Illig.).

Such are

The *Sc. striatus*, Lin., which is found throughout northern Asia and America, particularly in the pine forests. The tail is less bushy than in the Common Squirrel of Europe, the ears smooth, and fur brown, with five black stripes and two white ones. [Those from America are specifically different, and indeed constitute two or three separate species.]

We ought also, most probably, to distinguish

#### THE GUERLINGUETS [*Macroscus*, Bodd.],—

Wherein the tail is long, and almost round, and the scrotum pendent and enormous. In both the Ground-squirrels and Guerlinguets, the teeth are similar to those of the true Squirrels.

Species of them occur on both continents.

#### THE TAGUANS, ASSAPANS, or Flying Squirrels, (*Pteromys*, Cuv.).—

Have already been separated. In these the skin of the flank, extending between the fore and hind legs, imparts the faculty of sustaining themselves for some instants in the air, and of making immense leaps. Their feet have long osseous appendages, which support a portion of this lateral membrane.

There is a species in Poland, Russia, and Siberia (*Sciurus colinus*, Lin.).—Greyish ash-colour above; white below; the tail only half the length of the body: size of a Rat; and which lives solitarily in the forests. Another in North America, smaller, with the tail only a fourth shorter than the body (*Sc. volucella*, Lin.): it lives in troops in the prairies of the more temperate districts.



In the Indian Archipelago there is one nearly the size of a Cat (*Sc. petaurista*, Lin.): but the same Archipelago produces smaller ones, as the *Sc. sagitta*, distinguished from the rest, the small ones especially, by its membrane, which, as in *Pt. petaurista*, forms an acute projecting angle behind the tarsus.

[M. F. Cuvier has subdivided this group into the Taguans (*Pteromys*), and Assapans (*Sciuropterus*), which latter term he applies to the smaller species, the hairs on the tail of which are arranged distachously: there are several eastern species, however, which appear to connect the two together.]

#### THE AYE-AYE (*Cheiromys*, Cuv.),—

The inferior incisors of which are still more compressed, and above all, more extended from front to back, resembling plough-shares. Their feet have each five toes, of which four of the anterior are excessively elongated; the medius being much more slender than the others; in the hind-feet, the thumb is opposable to the other digits; so that in this respect these animals are to the other rodents, what the Opossums are among the *Carnaria*.\* The structure of their head is otherwise very different from that of the other *Rodentia*, presenting a closer relationship with the *Quadrumana* [among which this remarkable genus is now ranged by almost general consent. It is, in fact, in the aggregate of its conformation, a Lemurine animal: in which group we have already seen that the lower canines are singularly modified, projecting forwards, and being approximated to each other; insomuch that the intervening incisors (except in *Galeopithecus*) are consequently extremely compressed and narrow, one pair of them being even sacrificed in the Indris. In the present genus, the whole of the incisors disappear, as in the ordinary *Rodentia*; the canines of both jaws occupying their site: but it is very doubtful whether, as in the true Rodents, these teeth have persistent formative pulps, as there does not exist another known instance of continuously growing teeth in any animal pertaining to the great divisions of *Primaria* and *Carnaria*.† What little is known of the osteology of *Cheiromys* is strictly

Lemurine; and no rodent possesses the rotation of the bones of the fore-arm, and free separate movement of the limbs as prehensile instruments, which are observed in this genus. Its habitat even is Madagascar, the metropolis of the Lemurine group of animals.]

One species only is known, discovered by Sonnerat (*Sciurus madagascariensis*, Gm.); as large as a Hare, of a brown colour, tinged with yellow; tail long and thick, with some black bristles; and large naked ears. It is a nocturnal animal, the movements of which seem painful to it; lives in burrows, and employs its long slender digit to convey food to its mouth.

Linnaeus and Pallas have brought together in one single group, under the general name of

#### RATS (*Mus*, Lin.),—

All the rodents possessed of clavicles which they could not distinguish by some obvious external character, such as the tail of the Squirrels or that of the Beaver; from which resulted the utter impossibility of assigning to them any common character: the greater number had merely pointed lower incisors, but even this character was subject to exceptions.

Gmelin has already separated the Marmots, Dormice, and Jerboas; but we carry their subdivision much further, from considerations founded on the form of their grinders.

#### THE MARMOTS (*Arctomys*, Gm.),—

Have, it is true, the inferior incisors pointed, as in the greater number of animals comprised in the great genus of Rats; but, as in the Squirrels [to which superior group they indubitably appertain], they have five molars on each side above, and four below, all of them sharply tuberculated; accordingly, some of the species are inclined to eat flesh, and feed upon insects as well as vegetables. They have four toes, and a tubercle in place of a thumb, to their fore-feet; and five toes to their hind feet. In other respects, these animals are nearly the direct reverse of the Squirrels; being heavy, with short limbs, a hairy tail of middle length or short, a large flat head, and they pass the winter in a state of

\* The Opossums were arranged among the *Carnaria* in the author's first edition.—Ed.

† The Wombat presents the only instance amongst the *Marsupialia*.



Fig 46.—The Aye aye.

lethargy in deep holes, the entrance of which they close with a quantity of grass.\* They live in society, and are easily rendered tame.

Two species are known in the Eastern continent. The Alpine Marmot (*Mus. alpinus*, Lin.), as large as a Rabbit, with a short tail, and yellowish-grey fur, more ash-coloured towards the head, which inhabits lofty mountains immediately below the perpetual snow line; and the Polish Marmot, or Bobac (*M. bobac*, Lin.), the same size as the other, and yellowish-grey, with a russet tint about the head; it inhabits the lesser mountains and hills from Poland to Kamtschatka, and often burrows in the hardest ground. Russian travellers in Bucharia mention some others, as *Arct. fulvus*, *leptodactylus*, and *musogarius*, which are perhaps not sufficiently determined. America likewise produces several Marmots.

Under the name of

SOUSLIKS (*Spermophilus*, F. Cuv.).—

May be distinguished several Marmots which have cheek-pouches. Their superior lightness has caused them to be designated Ground-squirrels, [and they connect the true Squirrels with the foregoing]. Eastern Europe produces one,—

*M. citellus*, Lin.—A pretty little animal, of a greyish-brown, waved or mottled with white, the spots small, which is found from Bohemia to Siberia. It has a particular fondness for flesh, and does not spare even its own species. [There is another in Russia, *Sp. guttatus*, Tem., and more, further eastward, as *Sp. xanthopyrmus*, a native of Trebizond; but North America produces by far the greater number, some of which are beautifully marked with white lines along the back, between each of which is a series of white spots in the elegant *Sp. hoodii*.]

It appears that we should approximate to the Marmots, a rodent remarkable for the habit of living in great troops, in immense burrows, which have even been styled villages. It is called the *Prairie Dog* or *Barking Squirrel*, on account of its voice, which resembles the bark of a small Dog: the *Arctomys ludovicianus* of Say. M. Rafinesque, who [erroneously] ascribes to it five toes to each foot, has formed of it his genus *Cynomys*. [It is in every respect a true Marmot.

All the foregoing genera, with the prominent exception of *Cheiromys*, are simply modifications of a single peculiar type, and together compose the first principal section of the *Sciuridæ* or Squirrel family.]

THE DORMICE (*Myoxus*, Gm.).—

Have the lower incisors pointed, and four grinders, the crown of each of which is divided by closely-folded lines of enamel.

They are pretty little animals, with soft fur, a hairy and even tufted tail, and lively expression: they inhabit trees like the Squirrels, and subsist on their produce. In the very numerous order of rodents, this is the only subgenus which is destitute of a cæcum. They become torpid in winter, like the Marmots, passing that season in a very profound lethargy: and so natural is it for them to fall into this state, that a species from Senegal (*M. Coupeii*), which had probably never experienced it in its native country, became torpid in Europe as soon as it was exposed to cold.

The Fat Dormouse (*M. glis*, Lin.).—Size of a Rat; greyish ash-brown above, whitish underneath; of a deeper brown around the eyes; tail very hairy throughout its length, and disposed somewhat like that of a Squirrel, frequently also a little forked at its extremity. It inhabits the south of Europe, and nestles in the holes of trees and fissures of rocks. It sometimes attacks small birds. This is probably the *Rat* fattened by the ancients, among whom it was considered a great delicacy. [It is still eaten by the modern Italians.]

The Garden Dormouse (*M. nitela*).—Somewhat less than the preceding; greyish-brown above, white beneath; black round the eye, which extends spreading to the shoulder; the tail tufted only at the end, and black, with its extremity white. This species is common in gardens, where it shelters itself in holes about the walls, and does much injury to the fruit-trees nailed to them. [It does not occur in Britain.]

The Red Dormouse (*M. avellanarius*, Lin.).—Size of a Mouse; cinnamon-red above, white beneath; the hairs of the tail disposed somewhat like a feather. From the forests of all Europe. It constructs its nest of grass on low branches, in which it rears its young: the rest of its time, and particularly during winter, it remains in the hollows of trees.

[It has been said that this species cannot pierce a ripe nut-shell, and that its specific name does not correctly apply; but in confinement we have frequently seen it penetrate to the kernel of the hardest hazel-nuts.

THE GRAPHYRUS (*Graphyurus*, F. Cuv.).—

Scarcely differ from the Dormice externally, but have weaker jaws, and a longer and more slender intestinal canal: their molars are of small size, and simple structure: and they have also no cæcum to the intestine.

\* The Ground-Squirrels (*Tamias*), and even the members of the restricted group *Solomys*, are more or less subject to become torpid in winter.—Ed.

## REPTILES.

Two species have been described, both from South Africa.

The *Dormice* and *Graphyures* compose the second and last division of the *Schizide* or *Squirrel* family]. We approximate to the *Dormice*, [but with questionable propriety].—

### THE ECHYMYDS (*Echymys*, Geof.; *Loncheros*, Illig.)—

Which also have four grinders, but differently formed; the superior consisting of two laminae bent like a V; the inferior of one bent and one simple lamina. The fur of several species is rough, with intermixed flattened spines or prickles. They inhabit America. One of them,

The Golden-tailed Echymyd (*Hystrix chrysuro*, Schreb.), is more than double the size of the Brown Rat; it is a handsome animal, of a brown maroon-colour, the belly white, with a crest of elongated hairs and a longitudinal white band on the head; the tail long, and black, with its posterior half yellow. From Guiana. Another, The Red Echymyd (*Ech. rufus*; the *Spinous Rat* of Azara), of the size of a Rat, reddish-grey, with tail shorter than the body, is found in Guiana, Brazil, and Paraguay. It excavates long subterranean burrows. [These species with hairy tails pertain to the *Nelomys* of M. Jourdan, who restricts the term *Echymys* to the following.]

Others have merely the ordinary kind of hair, more or less rough.

The most remarkable is *Ech. dactyliscus*, Geof., the Long-toed Echymyd, which is still larger than the Golden-tailed species, and has the two middle toes of the fore-feet double the length of the lateral ones: its scaly tail is longer than the body; fur yellowish grey; the hairs on the nose forming a crest directed in front.

The *Mus paradoxus*, Thomas (*Lín. Trans.* xi., *Heteromys*, Lesson), apparently differs only from the Echymyds in possessing cheek-pouches. However, not having seen its teeth, I cannot arrange it.

### [THE CERCOMYDS (*Cercomys*, F. Cuv.)—

Are closely related to the preceding, and have also four molars surrounded with enamel, which are deeply indented internally, and inclose three insulated circlets of enamel near their external border: their form is still more Rat-like, but with the profile of the visage arched; there are no spines in the fur, and the tail is long and scaly.

One species (*C. brasiliensis*) is figured by M. F. Cuvier in his great work on Mammalia].

### THE HYDROMYDS (*Hydromys*, Geof.)—

Are in many respects related to the Echymyds externally; but they are distinguished from all other Rats by their hind-feet, two-thirds of which are palmated: their molars, also, two in number above and below, have a peculiar character in the crown, which is divided into obliquely quadrangular lobes, the summits of which are hollowed out like the bowl of a spoon. They are aquatic.

Several have been sent to Europe from Van Diemen's Land, some with the belly white, others with a fulvous belly, but all deep brown above, with a long tail which is black at the base, the distal half white. They are sometimes double the size of the Brown Rat. *H. hydrogaster* and *H. leucogaster*, Geof. [The former is variable, but the latter notwithstanding appears to be another species.]

### THE HOUTIAS (*Capromys*, Desm.)—

Have four molars above and below, with flat crowns, the enamel of which is folded inward, so as to form three re-entering angles on the external border, and only one on the internal side of those above, and the inverse in the lower ones. Their tail is round, and slightly hairy. Like the Rats, they have five toes to their hind feet, and four with the rudiment of a thumb to the anterior; their form is that of Rats as large as a Rabbit or Hare.

Two [three] species are known [all from the West Indies], which, together with the *Agoutis*, formerly constituted the chief game of the indigenous inhabitants. *Isodon glirides*, Say, refers to one of them. [They are not distantly allied to the Porcupines. It is remarkable that these animals hold up their food (a fusiform root for instance) with one foot only to the mouth, resting on the other three. They ascend bushes with facility.]

### THE RATS, properly so called, (*Mus*, Cuv.)—

Have three molars to each jaw, the anterior of which is the largest [and the posterior smallest], and the crowns of which are divided into blunt tubercles, which, by attrition, acquire the form of a disc variously indented; their tail is long and scaly. These animals are very annoying from their fecundity, and the voracity with which they gnaw and devour substances of every kind. There are three species very common in houses, namely,

The Common Mouse (*M. musculus*, Lín).—Known in all times and all places.

Europe during the middle ages. It is more than double the size of the Mouse in all its dimensions. The fur is blackish [with the ears much larger, and the tail longer, than in the following. There is a brown variety of this species, which is common in Persia, and appears to have been figured by M. F. Cuvier as the Surmulot.]

The Brown Rat, or Surmulot (*M. decumanus*, Linn.), which did not pass into Europe till the eighteenth century, and is now more common in large cities [and elsewhere, except in remote isolated localities,] than the Black Rat itself; it is a fourth larger than that species, and is also distinguished by its brown colour. This animal appears to belong to Persia, where it lives in burrows: it was not till 1727, that, after an earthquake, it arrived at Astracan, by swimming across the Volga.

It would seem that the Black Rat, also, originated in the East; and these two large species, together with the Mouse, have been transported in ships to all parts of the globe.

[Of the very numerous others, it must suffice to name the huge Bandicoot Rat of India (*M. giganteus*, Hardw.), which is much larger than the Surmulot. Those indigenous to South America have more complicated folds of enamel to their molars.\*] Some have spines mingled with their fur, as

The Cairo Mouse (*M. eahirinus*, Geoff.), which has spines on the back in place of hairs, and was noticed by Aristotle.

[Only two strictly indigenous British Mice have hitherto been described: the first, extremely diminutive, is the Harvest Mouse (*M. messorius*, Shaw), with short ears, and red fur, similar to that of the Common Dormouse: it constructs a beautiful round or pear-shaped nest, attached to corn-stems, or placed in low bushes; and is remarkable for its tail being slightly prehensile at the extremity. The second is commonly termed the Long-tailed Field Mouse (*M. sylvaticus*), and might almost form a separate subgenus; it rather exceeds the common Mouse in size, with proportionately larger ears, and much larger and very brilliant eyes; a brown mark in the centre of the chest: it is a pretty and very active species, more generally diffused than the Harvest Mouse, and never enters buildings, where the other is often carried with the sheaves.]

Warm climates produce Rats, similar in every detail to those of which we have just spoken, except that their tails are more hairy. Such are

*Hypodæus variegatus*, Licht., var. *flava*; *Meriones syenensis*, Id. To which must be added the *Arvicola messor*, Le Conte; *Arv. hortensis*, Harl., or *Sygmodon*, Say, distinguished however by its hairy ears, like the *Otomys*.

Another group, also with a hairy tail, but the teeth of which wear away faster, comprises the *Hypodæus obesus*, Licht., the *Mus ruficaudus*, Id., and also the *Meriones sericeus* of the same naturalist, characterized by the projecting ridges of the molars, which alternately catch in each other.

We have then to group the *Neotoma floridanum* of Say, or the *Arvicola floridana* of Harlan, and the *Arvicola gosypina*, Le Conte, two species which, size excepted, are very similar even in their colours, and the molars of which, provided with roots [after a while], when worn a little, have crowns similar to those of the *Arvicola*. [The tail in one of them is covered with hair of tolerable length. Both inhabit North America.]

*Reithrodon*, Waterh., requires also to be introduced here, distinguished by its grooved upper incisors, its arched and Rabbit-like head, great eyes, and large and round ears. Three or four species are known, from South America, where they were discovered by Mr. Darwin.

The *Pseudomys* of Gray is another Rat-like animal, remarkable for inhabiting New Holland: the anterior molar of its lower jaw is however more compressed and elongated, and there is a claw on its rudimentary thumb. The species, *Ps. australis*, inhabits holes in swampy places, at Liverpool plains.

It is necessary also to introduce here the *Haplotis albiges*, Licht.; *Coniurus constrictus*, Ogilby; another rodent from New Holland, the size of a Rat, with delicate ample ears, and a long, hairy, and somewhat tufted tail. It is remarkable for constructing an above-ground habitation, so firmly interlaced with thorny twigs externally, as to repel the Dingo or semi-wild Dog of that country.]

#### THE GERBILS (*Gerbillus*, Desm.; *Meriones*, Illig.)—

Have molars scarcely differing from those of the Rats, merely becoming sooner worn, so as to form transverse ridges. Their upper incisors are furrowed with a groove; their hind feet are somewhat longer in proportion than those of Rats in general, with the thumb and little toe but slightly separated: their tail is [very] long and hairy, [and generally tufted].

The sandy and warm parts of the eastern continent produce several species, [mostly of a light buff colour, white underneath].

#### THE MERIONS (*Meriones*, F. Cuv.)—

Which we separate from the Gerbils, have the hind feet still longer, the tail nearly naked, and a very small tooth before the superior molars; characters which approximate them to the Jerboas: their superior incisors are grooved, as in the Gerbils, and their toes also are similar.

There is a small species in North America, *Mus canadensis*, Fag.; *Dipus canadensis*, Shaw; *D. americanus*,

\* Certain of these, the upper lip of which is scarcely fissured, come from South Africa, which constitutes the *Dendromys* of Smith: they scarcely differ in structure from the British Harvest Mouse.—F.

Barton. Its agility is extreme, and it closes itself up within its burrow, and passes the winter in a state of lethargy. The *Gerbillus labradorius*, Harl., or *Mus labrad.*, Sabine, constitutes another.

#### THE HAMSTERS (*Cricetus*, Cuv.)—

Have teeth nearly similar to those of the Rats, but their tail is short and hairy, and the two sides of their mouth are hollowed (as in certain Monkeys) into sacs or cheek-pouches, in which they transport the grain they collect to their subterraneous abodes.

The Common Hamster (*Mus cricetus*, Lin.).—Larger than the Rat, of a reddish-gray above, black on the flanks and underneath, with three white spots on each side; its four feet are white, and there is also a white spot under the throat, and another under the breast; some individuals are all black. This animal, so agreeably variegated in colour, is one of the most hurtful in existence, on account of the quantity of grain which it hoards up, filling its hole, which is sometimes seven feet in depth. It is common in all the sandy districts, that extend from the north of Germany to Siberia. The latter country produces several smaller species.

#### THE VOLES (*Arvicola*, Lacep.)—

Have three grinders above and below, like the Rats, but without roots, and which are each formed of triangular prisms, placed alternately in two lines. [Their incisors (or *tusks*), unlike those of the preceding genera, are rounded, having an oval section.] They require to be subdivided into several groups, viz:—

##### THE MUSKQUASH (*Fiber*, Cuv.; [*Ondatra*, Laceped.]),—

Which is a Vole with semi-palmated hind-feet, a long, scaly, and compressed tail, of which one species only is well known,—

The Ondatra, *Muskquash*, or *Musk Rat* of Canada (*Castor sibiricus*, Lin.; *Mus sibiricus*, Gm.).—As large as a Rabbit, and reddish grey [the fur resembling that of the Beaver]. In winter they construct, on the ice, a hut of earth, in which several reside together, passing through a hole in the bottom, for the roots of the *Acorus* on which they feed. When the ice closes their holes, they are necessitated to devour one another. This habit of building has induced some authors to refer the Muskquash to the genus *Castor*.

The second subdivision is that of

##### THE ORDINARY VOLES (*Arvicola*, Cuv.; *Hypudaeus*, Illig.),—

The tail of which is hairy, and about the length of the body [or shorter], without webs to the toes.

The Water Vole (*Mus amphibius*, Lin.).—A little larger than the Black Rat, and deep greyish-brown; the tail as long as the body. Inhabits the banks of ditches, and burrows in marshy plains in search of roots; but it swims and dives badly. [This species has been known to occasion much damage, by burrowing into the raised banks of canals: in other respects it is quite harmless, except that it lays up a store of potatoes, &c., in its winter retreat, which is placed far from the water. Its ordinary food is green aquatic herbage. A black variety is not of uncommon occurrence, in many parts of Britain.]

The Alsacian Vole (*Mus terrestris*, Lin.).—Rather smaller than the last, with a shorter tail. It lives under ground like the Mole, preferring elevated fields, where it excavates galleries, and removes the earth to some distance from the opening. Its magazines, which are principally filled with the roots of the wild carrot cut into two-inch pieces, are frequently two feet in diameter. [It is not found in Britain.]

Meadow Vole (*Mus arvalis*, Lin.).—Size of a Mouse, reddish ash-colour, the tail a little shorter than the body. It inhabits burrows in the fields, in which it hoards up grain for the winter. By multiplying excessively, it sometimes occasions great damage. [There are several nearly allied small European species, two of which inhabit Britain: that known as *A. arvalis* in this country has the tail very short, and the ears inconspicuous; *A. pratensis* or *ripiicola* is redder, with a longer tail, and more apparent ears; it is less common than the other. Many more exist in Asia and North America, of which it will be sufficient to notice]

The Economic Vole (*Mus oeconomus*, Pallas.).—A little darker coloured than the foregoing, with the tail still shorter. It inhabits a sort of oven-shaped chamber, placed under the turf, from which issue several narrow and ramifying canals running in various directions; other canals communicate with a second cavity, wherein it amasses its provisions. From all Siberia. It is thought to have been also found in Switzerland and the south of France, particularly in the potato fields.

##### THE LEMMINGS (*Georychus*, Ill.; [*Lemmus*, Link.]),—

Have exceedingly short ears and tail, and fore-feet better adapted for digging. [In other respects, they only differ from the Voles in being rather more heavily formed.]

The two first species have five very distinct nails to their fore-feet, as in the Mole-rats and Helamys.

The Scandinavian Lemming (*Mus lemmus*, Lin.).—A northern species, the size of a Rat, with fur variegated black and yellow: it is very celebrated for its occasional migrations in immense bodies. At these periods they are said to march in a straight line, regardless of rivers or mountains; and while no insurmountable obstacle impedes their

progress, they devastate the country through which they pass. Their ordinary residence appears to be the shores of the Arctic Ocean.

The Siberian Lemming, or Zocor (*Mus aspalax*, Gm.)—Reddish-grey; the three middle nails of the fore-feet long, arcuated, compressed and trenchant, for cutting earth and roots. The limbs are short; there is scarcely any tail; and the eyes are exceedingly small. From Siberia, where it lives under-ground, like the Moles and Mole-rats, and subsists chiefly on the bulbs of different *Liliaceæ*.

The third species, like the other animals comprehended under the great genus of Rats, has only the rudiment of a thumb to its fore-feet. It is the Hudson's Bay Lemming (*Mus Hudsonicus*, Gm.); of a pearl-grey colour, without any tail or external ears: the two middle toes of the fore-feet of the male seem to have double claws, the skin at the end of the toe being callous, and projecting from under the nail; a variety of conformation unknown except in this animal.\* It is as large as a Rat, and lives under ground in North America.

#### THE OTOMYDS (*Otomys*, F. Cuv.; [*Euryotis*, Brandt])—

Are nearly allied to the Voles, and have also three grinders, but composed of slightly arcuated laminæ, which are arranged successively in file, so as to present an exact miniature resemblance to the grinders of the Elephant. Their incisors are grooved longitudinally, and the tail and ears are hairy, the latter being also large.

The only known species, the Cape Otomyd (*O. capensis*, F. Cuv.), inhabits Africa, and is of the size of a Rat, with fur annulated black and fulvous. Tail a third shorter than the body.

#### THE JERBOAS (*Dipus*, Gm.)—

Have nearly the same teeth as the Rats properly so called, differing only in the occasional presence of a very small tooth, placed before the superior molars. Their tail is long and tufted at the end, the head large, and eyes large and prominent; but their principal character consists in the immoderate length of the hinder limbs, as compared with the anterior, and above all, in the metatarsus of the three middle toes, which is formed of a single bone, as in what is termed the tarsus of birds. This disproportion of the limbs caused them to be designated *two-footed Rats* by the ancients: and in fact their ordinary gait is by great leaps on the hind-feet. Their fore-feet have each five toes; and in certain species, besides the three great ones to the hind-feet, there are [one or two] small lateral toes. These rodents live in burrows, and become profoundly torpid in winter.

[There are numerous species, inhabiting Asia and Africa. Those with five toes have been brought together by some under the name *Alectaga*.]

#### THE HELAMYDS (*Helamys*, F. Cuv.; *Pedetes*, Ill.)—

Which are commonly termed *Jumping Hares*, have, like the Jerboas, the head large, as are also the eyes, a long tail, and very short fore-legs in comparison with the hinder; the disproportion, however, being much less than in the true Jerboas. Their peculiar characters consist in having four grinders, each composed of two laminæ; five toes to the fore-feet, armed with long and pointed nails, and four only to the hind-feet, all separate, even to the bones of the metatarsus, and terminated by large claws almost resembling hoofs. The number of their toes is accordingly inverse to that of the ordinary Rats. Their inferior incisors are truncated, and not pointed as in the Jerboas, and as in the majority of other animals which have been comprised in the great genus of Rats.

One species only is known, as large as a Rabbit, and pale fulvous, with a long tufted tail black at the tip (*Mus caffer*, Pallas; *Dipus caffer*, Gm.)—It inhabits deep burrows near the Cape of Good Hope. [The affinities of this curious animal are by no means obvious.]

#### THE MOLE-RATS (*Spalax*, Guldenstedt)—

Have also been very properly separated from the genus of Rats, although their grinders are three in number, and tuberculated as in the Rats properly so called, and also the Hamsters, and are merely a little less unequal; their incisors being too large to be covered by the lips, and the extremities of those of the lower jaw



Fig. 46.—Mole-rat.

\* The Plovers, and several other birds belonging to the same group, present a somewhat analogous conformation.—Ed.

trenchant, rectilinear, and not pointed: their limbs are very short; all their feet have five short toes, with flat and slender nails; their tail is short or wanting, and there is no external ear. They live under ground like the Moles, throw up the earth in the same manner, although provided with very inferior instruments for the purpose, and subsist entirely on roots.

The Blind Mole-rat, Zemny, or Stepitz (*Mus typhlus*, Pallas).—A singular animal, which, from its large head, angular at the sides, its short legs, the total absence of a tail or of any apparent eye, has a most shapeless appearance. The eye is not visible externally, and we merely find beneath the skin a small black globule, which appears to be organized like an eye, but which cannot serve for the purpose of vision, since the skin passes over it without opening, or even becoming thinner, and being as much covered with hair as on any other part. It exceeds our Rat in size, and has smooth ash-coloured fur, verging on red. Olivier supposed that this animal was alluded to by the ancients, when they spoke of the Mole as being totally blind.

The islands in the Straits of Sunda produce a Mole-rat as large as a Rabbit, of a deep grey colour, with a white longitudinal stripe upon the head (*Spalax javanicus*, Auct.)

#### [THE CANETS (*Rhizomys*, Gray; *Nyctocleptes*, Tem.)—

Have been approximated to the Mole-rats; but have small open eyes, and conspicuous naked ears: their head is large, the body round and massive; limbs short, with five toes to each foot, and thick and naked tail of mean length. There are three rooted molars on each side of both jaws, more complicated than in *Spalax*.

Two species are described, *Mus sumatrensis*, Raffles, which feeds chiefly on the roots of the bamboo, and *R. sinicus*, Gray.]

From the Mole-rats themselves should have been separated—

#### THE BATHYERGUES (*Bathyergus*\*, Ill.; *Orycteropus*, F. Cuv.)—

Which, with the general form, the feet, and truncated incisors of the preceding, combine four molars to each jaw: their eyes, though small, are distinctly perceptible; and they have a short tail.

The Shore Bathyergue (*Mus maritimus*, Gm.).—Nearly the size of a Rabbit, with grooved upper incisors, and whitish-grey fur. Also the Cape Bathyergue (*M. capensis*, Gm.), scarcely as large as a Guinea-pig, brown, with a spot around the eye, another round the ear, and a third on the vertex, together with the end of the muzzle, white. The incisors of this species are smooth. There is a third, also, with smooth incisors like the last, grey, and hardly equal in size to a Rat (*B. hottentotus*).

We should place near the Mole-rat and Bathyergues

#### THE PSEUDOSTOMES (*Geomys*, Rafinesque; *Pseudostoma*, Say; *Ascomys*, Licht.; [*Saccophorus*, Kuhl])—

Which have likewise four molars above and below, prismatically compressed: the first double, the three others simple; and the upper incisors of which are furrowed with a double groove in front. Their three anterior middle nails, the medial more especially, are very long, crooked, and trenchant. They are low on the legs, and have very deep cheek-pouches, which open externally, enlarging the sides of the head and neck in a singular manner.

Only one species is known (*Mus burdarius*, Shaw), of the size of a Rat, with reddish-grey fur; the tail naked, and shorter by half than the body. It inhabits deep burrows, in the interior of North America. The figure of this animal in the *Linnæan Transactions* resembles nothing in nature, having the cheek-pouches turned inside out.

#### THE GAUFFRES (*Diplostoma*, Rafin.)—

Scarcely differ from the preceding, except in the total absence of a tail.

They are from North America. The species before us is reddish, and ten inches in length. [Eight or ten species pertaining to this and the preceding subdivision are now known, one or more inhabiting Europe.

#### THE SACCOMYDS (*Sacomys*, F. Cuv.)—

Have similar cheek-pouches, and four rooted molars on each side of both jaws, successively lessening. They have five toes on each foot, the anterior thumbs very small; tail long and naked.

The only species described (*S. xanthophilus*) inhabits North America, and is of the size and has much the aspect of a Mouse. Its cheek-pouches were distended with the flowers of *Securidaca volubilis*, with some entire seeds, apparently of *Convolvulus*.

\* This name is now confined to certain species which have only three molars. *Orycteropus*, however, is also applied to a genus of *Edentata*.—Ed.



We now pass to larger rodents than those of which we have hitherto spoken, but of which several have still well-developed clavicles.

Of this number are

THE BEAVERS (*Castor*, Lin.).—

Which are distinguished from all other rodents by their horizontally-flattened tail, of a nearly oval form, and covered with scales. They have five toes on each foot, the hinder being webbed, and a double and oblique nail on the digit next the thumb. Their grinders, four in number above and below, with flat crowns, appear as if formed of a doubled bony fillet, exhibiting one deep indentation on their internal border, and three on the outer edge above, and the reverse below.

They are rather large animals, and are aquatic in their mode of life; their feet and tail assisting them in swimming. As they subsist chiefly on bark and other hard substances, their incisive teeth are very robust, and grow as rapidly from the root as they wear at the tip. By means of them they are enabled to cut down trees of various kinds.

Large glandular pouches, which terminate on the prepuce, secrete a pomade of very pungent odour, which is employed in medicine under the name of *Castoreum*. In both sexes, the organs of generation terminate within the extremity of the rectum, so that they have only one external orifice.

The Beaver of Canada (*C. fiber*, Auct.).—Surpasses the Badger in size, and is, of all quadrupeds, the most industrious in fabricating its dwelling; to erect which many work in concert, in the most retired districts of North America.

Beavers choose water of such a depth as is not likely to be frozen to the bottom, and, whenever possible, running streams, that the wood which they cut above, may be carried downwards by the current to where they require it. They maintain the water at an equal height, by dams constructed of branches of trees, mixed with clay and stones, and repair them year after year, till a hedge is at length formed by the germination of part of the materials. Each hut serves for two or three families, and is divided into two apartments; the upper dry, for the habitation of the animals; the lower under water, for the provision of bark. The latter only is open, having its entrance under water, without any communication with the land. The huts are formed of interlaced twigs and branches, having their interstices closed up with mud. There are always several burrows along the bank, in which these animals seek for refuge when their huts are attacked. They only inhabit them during the winter; dispersing in summer, at which season they live solitarily.

The Beaver is easily tamed, and accustomed to feed on animal substances. Those of Canada are of a uniform reddish brown; and their fur, as every one knows, is in much request for hatting. It is sometimes flaxen-coloured; at others black, or white. We have been unable to ascertain, on the most scrupulous comparison, whether the Beavers which inhabit burrows along the Rhone, the Danube, the Weser, and other rivers of Europe, are specifically different from those of America; and whether the vicinity of man prevents those of the eastern continent from building.

THE COYPU (*Myopotamus*, Commerson).—

Resembles the Beaver in size, in having four molars almost similarly compressed, in the robustness of its yellow-coloured incisors, and in having five toes to each foot, those of the hinder palmated; but its tail is long and rounded, [and its skull dissimilar].

We only know one (*Mus coypus*, Molina), which lives in burrows beside the rivers of South America. Its yellowish-grey fur, mixed with down at the root, is employed by hatters like that of the Beaver, and is consequently an important article of commerce. Thousands of their skins are sent to Europe. [This species, like the Beaver, is easily tamed, and appears to withstand the climate of this country.]

THE PORCUPINES (*Hystrix*, Lin.).—

Are recognized at the first glance by the stiff and pointed quills with which they are armed, somewhat as in the Urchins or Hedgehogs, among the *Carnaria*. Their grinders are four in number above and below, with flat crowns differently modified by lines of enamel, between which are depressed intervals. Their tongue is roughened by spiny scales. The clavicles are too small to rest on the sternum and scapular, being merely suspended by the ligaments. They live in burrows, and have very much the habits of Rabbits. From their grunting voice, and thick truncated muzzle, they have been compared to Pigs, whence their French name of *Porc-épin* or *Porcupine*.

THE PORCUPINES, properly so called (*Hystrix*, Cuv.).—

Have the head more or less convex, on account of the development of the nasal bones. They have four toes before and five behind, furnished with stout claws.

That of Europe (*H. cristata*, Lin.) inhabits the South of Italy, Sicily, and Spain. Its quills are very long, and



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with hollow truncated tubes suspended by slender pedicels. Their heads and muzzles are singularly convex. There are other species not very different, but with the head less convex, inhabiting India and Africa. [These constitute the *Acanthion* of M. F. Cuvier; the *H. Myndensis*, Brandt, is however intermediate.]

We separate from the true Porcupines

### THE ATHERURES (*Atherura*, Cuv.),—

The head and muzzle of which are not inflated, and the tail long, but not prehensile; their feet are similar to those of the preceding.

The Pencil-tailed Atherure (*Hyst. fasciculata*, Lin.)—The quills on the body furrowed with a groove in front, and the tail terminated by a bundle of flattened horny slips, constricted at intervals. [Inhabits India and Malacca.]

### THE URSONS (*Erethizon*, F. Cuv.),—

Have a flat cranium, and short muzzle which is not convex: their tail is of middle length, and the spines short and half-hidden in the hair.

One species only is known, from [the Atlantic side of] North America (*Hyst. dorsata*, Lin.). [The *E. epixanthus*, Brandt, from the western side of the same continent, appears to be another. These animals produce but me young at a birth.]

### THE COENDOUS (*Syntheres*, F. Cuv. [*Cercolabes*, Brandt]).

Muzzle short and thick; the head convex above; quills short; and the tail, in particular, long, naked at the tip, and prehensile, as in a Sapajou or Opossum. They climb trees, and have only four toes on each foot.

In the warm parts of North America, there is a species with black and white spines, and brown-black fur (*Hyst. prehensilis*, Lin.); and a smaller kind in South America (*H. insidiosa*, Licht.), the prickles of which are partly red or yellow, and hidden during part of the year by its long greyish-brown fur. [M. d'Orbigny is of opinion that these constitute but one species. In Brandt's memoir on the Porcupines, however, they are referred to different subgenera, after M. F. Cuvier; the first, with the addition of another (*S. platycentrotus*), to *Syntheres* as restricted, the other, with two more species (*S. nigricans* and *S. affinis*), to a subdivision *Sphiggurus*.

### THE AULACODON (*Aulacodus*, Tem.)

Incisors very broad, the upper furrowed with two grooves, and a third at their inner margin: four molars as in the preceding, those of the upper jaw with a single deep fold of enamel within, and two without, excepting the anterior, which has three; in the lower jaw, the outer margin has only one fold, and the inner two. There are five toes before and four behind, and some flattened spines mingled with the fur. The form is that of a Rat, with the molars of a Porcupine.

*A. swinderianus*, Tem., is the only known species, from the Eastern Archipelago].

### THE HARES (*Lepus*, Lin.)—

Have a very distinctive character, in their superior incisors being double; that is to say, there is another of small size behind each of them\* [or, in other words, two genuine incisive teeth are present in these animals, posterior to the ordinary representatives of the tusks or canines]. Their molars, five in number above and below, are each of them formed of two vertical laminae soldered together, and in the upper jaw there is a sixth, simple and very small. They have five toes before, and four behind; an enormous cœcum, five or six times the size of the stomach, and lined internally with a spiral layer throughout its whole length. The interior of their mouth and the under part of their feet are covered with hair like the rest of the body.

### THE HARES, properly so called (*Lepus*, Cuv.),—

Are distinguished by their long ears, short tail, hind-feet much longer than the fore, imperfect clavicles, and antorbital space in the cranium widely pierced and reticulated. There are numerous species in both hemispheres, which from their resemblance are difficult to characterize.

[Four occur in the British islands. The Common Hare (*L. timidus*, Lin.), with yellowish-brown fur, which has a tendency to curl; the Irish Hare (*L. hibernicus*), with shorter limbs and ears, and smooth reddish fur, of very

\* There is even a period when they are shedding their teeth, during which they appear to have three pair of upper incisors, one behind the other.

inferior value to that of the preceding, and which occasionally turns white in winter\*; the Variable Hare (*L. variabilis*), a mountain species, larger than either of the foregoing, with still shorter ears and limbs than the Irish Hare, and brown fur in summer, which always changes to white at the approach of winter; and the Rabbit (*L. cuniculus*), remarkable for its burrowing habits, and for bringing forth its young blind and naked, while the Leverets of the three others see and run from birth. Not less than sixteen species of *Lepus* are already known in North America; and many others exist in Asia and Africa.]

#### THE PIKAS (*Lagomys*, Cuv.)—

Have ears of moderate length, the limbs nearly equal, the antorbital foramen simple, almost perfect clavicles, and no tail whatever. They often utter a very sharp cry. They have hitherto been found only in Siberia [since, however, at a considerable altitude on the Hivamalayas, and in North America], and Pallas was the first to make them known.

[The largest of them] *Lepus alpinus*, Pallas, is the size of a Guinea-pig, and yellowish-red. It inhabits the most elevated mountain summits, where it passes the summer in selecting and drying the herbage for its winter provision. Its hay-stacks, which are sometimes six or seven feet high, are a valuable resource for the Horses of the Sable-hunters.

Some fossil remains have been discovered of an unknown species of Pika, in the accumulations of osseous breccia in the island of Corsica.

After the two genera of Porcupines and Hares, come the rodents which Linnæus and Pallas brought together under the name of *Cavia*, but for which it is impossible to assign any other constant and positive character than the imperfection of their clavicles, though the various species are not without analogy in the aspect of their body and manners. They are all from the New Continent.

#### THE CAPYBARA (*Hydrochærus*, Erxleben)—

Has four toes before, and only three behind, all of them armed with stout claws, and connected together by membranes; four grinding teeth above and below, the last of which [especially in the lower jaw] are the longest, all composed of numerous simple and parallel laminæ; the anterior of these laminæ forked towards the outer edge in the upper, and towards the inner one in the lower teeth. Only one species is known.



Fig. 47.—The Capybara.

The Capybara (*Cavia capybara*, Lin.), as large as a Siamese Pig, with very thick muzzle, short legs, coarse yellowish-brown hair, and no tail. Inhabits the rivers of Guiana and the Amazons, where it lives in troops: is a good swimmer, and the largest [existing] species of the *Rodentia*. The Beaver alone approaches it in size.

#### THE CAVIES, popularly termed *Guinea-pigs*, (*Anama*, F. Cuv.; *Cavia*, Illig.)—

Are miniatures of the Capybara, except that their toes are separated, and their molars have each only a simple lamina, together with a forked one externally in those above, and on the inside in the lower.

The species best known is the common domestic Cavy, or *Guinea-pig* (*Cavia cobata*, Pallas; *Mus porcellus*, Lin.), extremely common now in Europe, where it is bred in houses, under the [mistaken] supposition that its odour drives away Rats. It varies in colour like other domestic animals. [Six or seven species are now known, one of which, the Patagonian Cavy (*C. patachonica*, Pen.), is much larger than the rest, with remarkably long limbs: the author suspected it to be an Agouti. Some separate it by the appellation *Dolichotis*.]

#### THE MOCOS (*Kerodon*, F. Cuv.)—

Have grinders rather more simple than those of the Cavies, each being formed of two triangular prisms.

The only known species is also from Brazil, somewhat surpassing the Guinea-pig in size, and of an olive-grey colour.

\* The Irish Hare has only recently been distinguished, and has hitherto been met with only in that island, where, until lately, the Common Hare was unknown. Great numbers of the latter, however, have been turned loose there during the last twelvemonth.

THE AGOUTIS (*Chloromys*, F. Cuv.; *Dasyprocta*, Ill.)—

Have four toes before and three behind, and four grinders above and below, of nearly equal size, with flat crowns irregularly furrowed, and a rounded contour, notched on the inner edge of those above, and the outer of those below. In disposition and the nature of their flesh, they resemble Hares and Rabbits, which they in some degree represent in the Antilles and hot parts of America.

[Several species have been ascertained, one with only two toes to the hind-feet. They employ their fore-feet to hold up food to the mouth.]

THE PACAS (*Calogenys*, F. Cuv.; *Osteopera*, Harl.)—

With teeth pretty much resembling those of the Agoutis [and Porcupines], combine a very small additional toe on the inner side of the fore-foot, and two, equally small, on the sides of the hind-foot, which have consequently five in all. Besides this [and in addition to ordinary cheek-pouches], there is a cavity hollowed in each cheek, which dips under the projection of a very large and salient zygomatic arch, which imparts an extraordinary aspect to the skull. Their flesh is understood to be fine eating.

There is one species or variety of a fulvous colour, and another brown, both of which are spotted with white (*Cavia paca*, Lin.).

Finally, there remains an animal perhaps allied to *Cavia*, perhaps more approximating to *Lagomys*, or to the Rats, which we are unable to arrange for want of knowing its dentition,—the Chinchilla of the furriers, the skins of which are imported in immense numbers, but the body we have never been able to obtain. \* \* \*

The Viscacha, described by Azzara, and such as we have seen it figured, can hardly be other than a large species of Chinchilla, with shorter and coarser fur.

[The progress of discovery has realized this expectation of the author, and we are now acquainted with three subdivisions of these animals, all of which have four rootless molars above and below, composed of alternating transverse layers of enamel and ivory: the form of the cranium and lower jaw indicates considerable affinity with the Cavies; but the clavicles are developed, and the aspect altogether more Rabbit-like, or rather approximating that of the Pikas; the eyes are placed far backward, the whiskers remarkably long and conspicuous, and the tail is always held recurved. These animals live socially in extensive burrows. The first subdivision is that of

THE VISCACHA (*Lagostomus*, Brookes),—

In which the fore-feet are furnished with four toes, the hinder with three only, as in the Cavies, all of them armed with stout claws adapted for digging. The ears are of moderate size, and the tail comparatively short. Their three anterior molars of the upper jaw consist each of two double layers, and the last of three; the lower of two each throughout.

The only known species (*L. trichodactylus*, Brookes,) is about the size of a Hare, and inhabits Chili and Brazil: its general colour is greyish, the fur of two sorts, one entirely white, and the other, which is coarser, black, except at the base; the under parts white. Its motions are quick, and resemble those of a Rabbit; and it seeks its food by night, subsisting wholly on vegetables: inhabits the level country, and is not esteemed as food. This animal is figured in Griffith's edition of the present work under the name of *Diana Marmot*.

The others are mountain animals, which frequent rocky places near the snow-line.

THE CHINCHAS (*Lagotis*, Ben.; *Legidium*, Meyer)—

Scarcely differ from the Viscacha except in having four toes to each foot, and a long bristly tail, as in the Chinchilla.

Two species are known; the first with long Rabbit-like ears, and greyish fur, from the Peruvian Andes (*L. Cuvieri*, Ben.; *Legid. peruvianum*, Mey.); the other from the Chilian Andes, with shorter ears, and fur inclining to reddish-brown (*L. pallipes*, Ben.).

Lastly,

THE CHINCHILLA (*Chinchilla*, Ben.; *Eriomys*, Vander Hoeven; *Callomys*, Gray),—

Has a fourth very small internal toe on the hind-foot: ears ample; the internal auditory bullæ remarkably capacious, appearing on the upper part of the skull. Each of the upper molars has three alternate layers of enamel and ivory, the inferior only two.

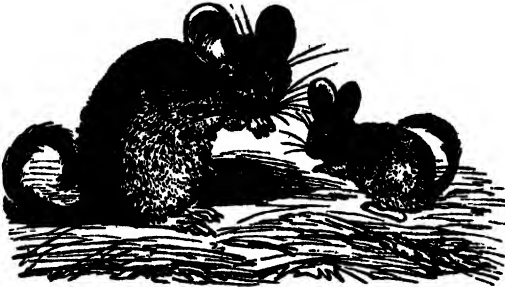


Fig. 43.—The Chinchilla.

One species only is well determined, the Chinchilla of the furriers (*Ch. lanigera*, Ben.), celebrated for the delicate fineness of its fur. It inhabits the Chilian and Peruvian Andes.

Somewhat allied to the foregoing, is another small group of South American rodents, with also four rootless molars of equal size above and below, except in one instance (*Abrocoma*), where the inferior resemble those of an *Arvicola*; they are surrounded with enamel, and doubled, or indented deeply, on both sides. The antorbital foramen is very large. There are five toes to each foot, ex-

cept in *Abrocoma*, which has only four anteriorly; and the general aspect is intermediate to that of the Chinchillas and Rats or Voles: the head, however, is arched. Four subdivisions have been distinguished. In

THE ABROCOMES (*Abrocoma*, Waterh.),—

The ears are large, the claws very small, and the tail rather long and not tufted. The excessive fineness of their fur probably exceeds that of any other animal.

Two species were taken near Valparaiso by Mr. Darwin, *A. Cuvieri* and *A. Bennettii*, Waterh.

THE OCTODONS (*Octodon*, Bennett; *Dendrobatus*, Meyer),—

Have also large ears, and a long and tufted tail: their inferior molars resemble those of the following.

The only known species (*O. Cummingii*, Ben.), is the *Sciurus degus* of Molina, *D. degus*, Meyer. It inhabits Chili, and is often seen traversing the branches of low underwood.

THE POEPHAGOMES (*Poephegomya*, F. Cuv.),—

Have narrow incisors, the auditory conch small, but distinct: claws adapted for burrowing.

The only ascertained species (*P. ater*) inhabits Chili.

Finally,

THE CTENOMYDS (*Ctenomys*, Ben.),—

Are distinguished by the great breadth of their incisors, by the smallness of their ears, their rather short tail, and stout claws, well qualified for burrowing.

There is a species in Brazil (*Ct. brasiliensis*, Blainv.), and another near the Straits of Magellan (*Ct. Magellanicus*, Ben.).

A remarkable African rodent, which is in several respects allied to the last, is known as

THE CTENODACTYLE (*Ctenodactylus*, Gray),—

The incisors of which are rounded; there are but three molars, however, on each side of both jaws, surrounded with enamel, the upper with one deep indentation externally, the lower indented on both sides. The feet have each four toes, with the rudiment of a thumb on the anterior; and the hinder especially are furnished with stiff brush-like bristles, which curve over the toes (a structure which is also seen in the last preceding subdivisions). The general aspect resembles that of the Chinchilla group, to which the structure of the lower jaw bears also some resemblance; and there are similar great whiskers on the upper lip.

But one species is known (*C. Massoni*, Gray), from North Africa; size of a Rat, with a short tail, and pale yellowish-brown fur, of very fine texture.

The foregoing arrangement of the extensive series of *Rodentia* is by no means reduced to that simplicity which we conceive will ultimately be attained. Mr. Waterhouse, who has recently studied these animals very attentively, has succeeded in detecting several unexpected affinities which tend to this result: and he finds that the most useful or least variable characters, indicative of the mutual relations of the several genera, are derivable from the configuration of the cranium, and especially that of the lower jaw. The space allotted in this work forbids our entering into details; so that it must suffice to state that, in general, the members

of the first grand division are distinguished by having the inferior projecting angle of the lower jaw subquadrate, and not tapering to an acute point. In this group, or series, range first the *Sciuridæ*, or Squirrels and Marinots, followed by the Dormice, and next by the Jerboas, which latter require to be interpolated between the *Sciuridæ*, and the *Muridæ* or Rats; the Jerboas evincing several peculiar points of relationship with the Dormice: the *Arvicolidæ*, or Muskquash, Voles, and Lemmings, together with the Guaffres (*Geomys*), follow the *Muridæ*, and then succeed two isolated genera,—*Castor* and *Helamys*, which seem to constitute particular families: all these successive groups being readily distinguishable by the structure of the cranium and inferior jaw, combined with other characters. The members of the next great group have the inferior angle of the lower jaw acute, and usually four equal molars on each side above and below, having their folds of enamel gradually more complex. *Abrocoma*, *Octodon*, *Poëphagomys*, *Ctenomys*, *Capromys*, *Echymys*, *Myopotamus*, *Aulacodon*, then *Hystrix* and its allies, and near to the last *Calogenys* and *Dasyprocta*, form a very intelligible series, after which the bony palate contracts anteriorly, and we arrive at the *Cavidæ*, or Capybara, Moco, and Cavies, succeeded by the *Chinchillidæ*, and lastly by the Hares and Pikas, near which it may be that the *Ctenodactyle* holds its station. In the terminal genera, or the *Léporidæ*, the angle of the jaw suddenly ascends. It is probable that multitudes of existing rodents still remain to be discovered, a knowledge of some of which may assist in improving the general arrangement. But few have hitherto been met with in the ancient tertiary deposits, and those of genera still extant, as that of the Dormice in particular.]

## THE SIXTH ORDER OF MAMMALIANS,—

### EDENTATA,—

Or quadrupeds without teeth in the fore-part of their jaws, constitute our last principal division of unguiculated animals. Although brought together by a purely negative character, they have, nevertheless, some positive mutual relations, particularly in the great claws which encompass the ends of their toes, and which more or less approximate to the nature of hoofs; also by a certain slowness, or want of agility, obviously arising from the peculiar organization of their limbs. There are certain tolerably well-marked intervals, however, in these relations, which subdivide the order into three tribes.

### THE TARDIGRADA

Compose the first of these divisions. They have a short face. The name refers to their excessive slowness, consequent upon a construction truly heteroclite, in which nature seems to have amused herself by producing something imperfect and grotesque. [A most strange assertion on the part of Cuvier, originating from a want of knowledge of the peculiar habits of these singular animals.] The only existing genus is that of

### THE SLOTHS [as they are badly named] (*Bradypus*, Lin.),—

Which have cylindrical molars, and sharp canines longer than these molars; two pectoral mammae; and the toes completely joined by the skin, and only marked externally by enormous compressed and crooked claws, which, when at rest, are always bent towards the palms, or soles, of the fore and hind feet. The latter are obliquely articulated on the leg, and apply only their outer edge; the phalanges of the toes are articulated by serrated ginglymi, and the first, at a certain age, becomes soldered to the metacarpal or metatarsal bones, which also, for want of use, become similarly ankylosed. To this inconvenience [?] in the organization of the extremities is added another, not less great, in their proportions. Their arms and fore-arms are very much longer than their thighs and legs, inasmuch

that, when these animals advance [on the ground], they are obliged to drag themselves forward on their elbows. The pelvis is so large, and the thighs so much directed outwards, that they cannot approximate their knees. Their gait is the necessary consequence of so disproportioned [unusual] a structure.\* These animals inhabit trees, and never remove from that on which they are located until they have stripped it of every leaf, so painful to them is the requisite exertion to reach another; it is even asserted that they let themselves fall from a branch to avoid the labour of descending. [The truth is, that these animals are modified for hanging by their limbs to the branches of trees, instead of supporting themselves upon the limbs like others: in this, their only natural posture, they are by no means slow in their movements; and they inhabit the densely intertangled forests of South America, where hundreds of miles may be traversed by passing from one tree to another: clinging by the hinder claws, the posterior limbs securely embracing the bough, and generally by one of their fore-limbs also, they employ the other to hook towards them the foliage on which they browse, whence the great length of their arms: and it is observed that in more open places, where the trees are less contiguous, the Sloths take advantage of windy weather to effect their transits, when the boughs are blown together and commingled. Their long and coarse shaggy hair protects them from insects: and in short, as is well remarked by Professor Buckland, the peculiar conformation of these animals ought no more to excite our pity and compassion, than the circumstance of fishes being deprived of legs. They are just as admirably adapted and fitly organized for their appointed singular mode of life as any other animal whatever.] The female produces but one young one at a birth, which she carries on her back.

The viscera of these animals are not less singular than the rest of their conformation. Their stomach [of enormous size] is divided into four compartments, somewhat analogous to the four stomachs of the ruminants, but without leaflets or other internal projecting parts; while the intestinal canal is short, and without a cæcum.

M. F. Cuvier applies the name *Acheus* to such of them as have three claws on their fore-feet; they have a very short tail.



Fig. 40.—The Aï, or Common Sloth

by this extraordinary animal, having an obvious reference to its peculiar habits. Some varieties of the Aï have been described as separate species, differing however in colour only: but the *Bradypus torquatus*, Geof., is very distinct, even in the bony structure of its head.

M. F. Cuvier reserves the name *Bradypus* for those species which have two claws only on their fore-feet (the *Cholepus*, Illig.). Their canines are longer and more pointed, and they are quite destitute of tail. We know but of one,

The Unau (*Br. didactylus*, L.), which is rather less unfortunately (*malheureusement*) organized than the Aï. Its arms are shorter, its clavicles complete; there are fewer bones of its fore and hind feet which become soldered together. Its muzzle is more elongated, &c. It is larger by one half than the Aï, and of an uniform greyish-brown, which inclines sometimes to reddish.

These two animals are indigenous to the hot parts of America. Were it not for their stout claws, they would probably have been long since exterminated by the *Carnivores* of that country. [The lofty canopy from which they hang is beyond the reach of such enemies. In their affinities, the Sloths are closely related to the *Myrmecophaga*.]

\* Sir A. Carlisle has observed that the arteries of the limbs commence by subdividing into numerous ramifications, which afterwards re-unite into a single trunk, from which the usual branches proceed. This structure being also met with in the *Loris*, the gait of which is almost equally sluggish, it is possible that it may exert some influence on this slowness of motion. [It occurs also in the Whale, and the

The Aï (*Br. tridactylus*, Lin.) is the species in which all the peculiarities of its genus are developed to the greatest extent. Its thumb and little toe, reduced to small rudiments, are concealed by the skin, and soldered to the metatarsus and metacarpus; the clavicle, also, reduced to a rudiment, is soldered to the acromion. Its arms are twice as long as its legs; the hair of its head, back, and limbs is long, coarse and unelastic, bearing some resemblance to dried grass, which gives it a forbidding aspect. The colour is greyish, often spotted with brown and white, [particularly when young]. Size that of a Cat. It is the only known mammalian which has nine cervical vertebrae [the fact being, that the eighth and ninth support rudimental ribs (as shown at Fig. 2, p. 39), and are therefore dorsal vertebrae, as in all the rest of the class: the more complete rotation of the neck, however, thus acquired

by this extraordinary animal, having an obvious reference to its peculiar habits].

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generality of birds, being connected rather with the power of protruding muscular exertion.] [Independently of this, the *Loris*, the Orang-outang, and the *Coïsta*, all very slow animals, are remarkable for the length of their arms. [Still more so are the Gibbons, which are distinguished for the agility of their movements.]

There have been discovered in America the fossil skeletons of two animals belonging to the order *Edentata* [and lately another not yet named], of enormous dimensions: the first of them, the *Megatherium*, has a head very similar to that of a Sloth, but without canines, and approximating in the rest of its skeleton partly to the Sloths, and partly to the Ant-eaters, [most of all, however, to the minute *Chlamyphorus*, having even been covered by a similar massive buckler]. It is twelve feet long, and six or seven high. The other, the *Megalonyx*, is rather less: its toes are the only parts that are well known, and they strongly resemble those of the other.

The second tribe, comprehending

#### THE ORDINARY EDENTATA,—

Have the muzzle pointed. They have still molar teeth, and are divisible into two genera.

#### THE ARMADILLOS (*Dasyus*, Lin.)—

Are very remarkable among the *Mammalia*, for the scaly and hard [bony] shell, composed of pavement-like compartments, which covers their head and body, and often the tail. This substance forms a shield upon their forehead, another larger and more convex on the shoulders, a third on the crupper

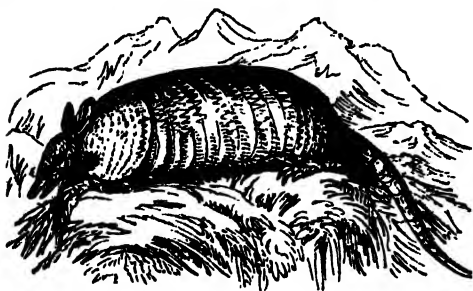


Fig. 50.—Felis Armadillo.

similar to the preceding, and between the two latter several parallel and moveable bands, which allow the body to bend. The tail is sometimes furnished with successive rings; and at others, with varied tubercles, like the legs. These animals have [generally] large ears, and also great claws, either five or four anteriorly, and always five to their hind-feet; a somewhat pointed muzzle; cylindrical grinding teeth separated from each other, to the number of seven or eight on each side of both jaws, and without enamel on the inside; a soft tongue, but little extensible; and there are a few scattered hairs between their scales,

or on those parts of the body not covered by the shell. They excavate burrows, and subsist partly on vegetables, and partly on insects and carcases: their stomach is simple, and there is no cæcum. All of them are indigenous to the warm or at least temperate regions of South America.

They may be arranged into subgenera, according to the structure of their fore-feet and the number of their teeth. The majority have only four toes anteriorly, of which the medial are the longest. Of this number are

#### THE CACHICAMES, F. Cuv.,—

Which have only seven teeth on each side of both jaws; a pointed muzzle; and long tail encircled with bony rings. Such are

The Black Armadillo of Azara (*D. novemcinctus*, Lin.), with nine intermediate bands, and sometimes but eight; also the Mule Armadillo of the same naturalist (*D. septemcinctus*), with a shorter tail than the preceding.

#### THE APARAS, F. Cuv.,—

Have toes the same as in the Cachicames, but nine or ten teeth above and below.

The Apara Armadillo of Azara (*D. tridactylus*, Lin.), with three intermediate bands, and a very short tail plated with regular tuberculated compartments. By enclosing its head and feet within its armour, this species is enabled to roll itself completely into a ball, like certain *Onisci*. It inhabits Brazil and Paraguay, and is one of those found farthest to the south.

Other Armadillos,

#### THE ENCOUBERTS, F. Cuv.,—

Have five toes to their fore-feet, of which the three medial are the longest: their tail is in great part covered with quincunx scales, and their teeth are nine or ten in number, above and below. In this subdivision ranges

The Encoubert Armadillo, *Payou* of Azara, (*D. acrocinetus* and *octodacemcinetus*, Lin.), which is distinguished from the rest of the genus by having a tooth on each side fixed in the intermaxillary bone: its coat of mail has six or seven bands, with smooth, large, and angular compartments; tail middle-sized, and annulated only at its base. The *Pichty* of Azara, and an allied species, the hairy Armadillo (*Tatus velu*, Az.), resemble the Encoubert except in wanting the intermaxillary teeth, in having the posterior shell denticulated, and the parts that are not plated clad with longer and more close-set hairs.

A third principal division of these animals exhibits five toes to the fore-feet, but disposed obliquely, so that the thumb and index are slender, the latter being longest, the middle one bearing an enormous trenchant claw, the next having a shorter claw, and the fifth being shortest of any. This structure enables them to cut up the ground, and burrow very rapidly, or at any rate to hold on so firmly to the sides of their excavation as to be very difficult to detach. In this subdivision, or

#### THE CABASSOUS,—

There are eight or nine teeth on each side of both jaws.

The *Cabassou propre*, Buff.; *Tatouay*, d'Az.; (*D. unicinctus*, Lin.)—Twelve intermediate bands; the tail long and tuberculated; the compartments of the bands and skin are square, and broader than long; five toes before, of which four are furnished with enormous claws, trenchant on their outer border. It attains a great size.

#### THE PRIODONTES, F. Cuv.,—

With five anterior toes still more unequal, and claws even exceeding those of the Cabassous, possess twenty-two or twenty-four small teeth on each side above and below, making eighty-eight or ninety-six in all. Such is

The Giant Armadillo (*D. gigas*, Cuv.)—With twelve or thirteen intermediate bands, a long tail covered with imbricated scales, the compartments of which are square, and broader than long. It is the largest species of Armadillo, being sometimes three feet in length without the tail.

At the termination of the Armadillos, as a very distinct subgenus, [genus, or even family, to which the colossal *Megatherium* also appertains], may be placed

#### THE CHLAMYPHORES (*Chlamyphorus*, Har.),—

Which have ten teeth on each side of both jaws, five toes on each foot, the anterior claws very large, crooked, compressed, and furnishing (as in the Cabassous) a very powerful cutting instrument [adapted for digging]. The back is covered with a series of scaly pieces, arranged transversely, without any solid buckler either before or behind, but forming a sort of cuirass, which is only connected with the body along the spine. The hind part of the body is abruptly truncated, and the tail incurved and partially attached to the under part of the body: [it is covered with small scales, and expanded at the tip. The osteology of this animal, as given by Mr. Yarrell (*Zool. Journ.*, No. xii.), is considerably allied to that of the Cabassous. There is a singular tuberosity on the skull over each eyebrow.

We know but of one (*Chlamyphorus truncatus*, Harlan), only five or six inches in length; it is a native of the interior of Chili, where it passes most of its time under ground, [and is either very rare (perhaps verging towards extinction), or difficult to obtain on account of its subterraneous habits].

N.B. There have been found, in America, some fossil bones of a gigantic Armadillo, which appears to have been about ten feet long exclusive of the tail. (See my *Ossemens Fossiles*, vol. v. part 1, p. 191, note.)

#### THE ORYCTEROPES (*Orycteropus*, Geof.)—

Have been long confounded with the Ant-eaters, inasmuch as they subsist on the same food, have a similar-formed head, and a tongue which is somewhat extensible; but they are distinguished by having grinding teeth, and flat claws, adapted for burrowing rather than for cutting open ant-hills. The structure of their teeth is different from that of all other quadrupeds; they are solid cylinders, traversed, like reeds, in a longitudinal direction, by an infinitude of little canals. The stomach is simple, and muscular towards its outlet, and the cæcum small and obtuse.

Only one species is known of this genus, the Cape Orycterope (*Myrmecophaga capensis*, Pallas), which the Dutch colonists style the *Ground Hog*. It is an animal about the size of a Badger or larger, low upon the legs, with scanty greyish-brown hair, and tail shorter than the body and as little clad. It inhabits burrows, which it forms with extreme rapidity; and its flesh is eaten.

The remaining *Edentata* possess no grinders whatever, and consequently have no teeth at all. There are two genera.



THE ANT-EATERS (*Myrmecophaga*, Lin.)—

Are well covered with hair, have a long muzzle which terminates by a small toothless mouth, from which is protruded a filiform tongue, susceptible of considerable elongation, and which they insinuate into ant-hills and the nests of the *Termites*, whence these insects are withdrawn by being entangled in the viscid saliva that covers it. Their fore-nails, strong and trenchant, which vary in number according to the species, enable them to tear open the nests of the *Termites*, and also furnish them with effective means of defence. When at rest, these nails are always half-bent inwards, resembling a callosity of the tarsus; hence these animals can only bring the side of the foot to the ground. Their stomach is simple, and muscular towards its outlet, their intestinal canal moderate, and without a cœcum.\*

The members of this genus are peculiar to the warm and temperate regions of South America, and produce but one young at a birth, which is carried on the back.



Fig. 61.—Great Ant-eater.

naked and prehensile at the tip, enabling the animal to suspend itself to the branches of trees. Some of them are of a yellowish-grey, with an oblique band on the shoulder, that is only visible at a certain light; others are fulvous with a black band; some fulvous, with the band, crupper, and belly black; and others again black altogether. It is not yet known whether these differences indicate species.

The Two-toed Ant-eater (*Myrm. didactyla*, Lin.).—Size of a Rat, with fulvous woolly hair; and a russet line along the back, the tail prehensile and naked at the tip, and only two claws anteriorly, one of them very large, and four to the hind-foot. [Were it not for the interposition of the preceding species, it is doubtful whether the author would have arranged this curious little animal in the same minimum group as *M. jubata*: it has been separated by some naturalists; and its close affinity with the Sloths is very obvious.]

THE PANGOLINS (*Mantis*, Lin.).—

Are also without teeth, have an extensile tongue, and subsist on Ants and Termites in the manner of the Tamanduas; but their body, limbs, and tail, are covered with large trenchant imbricated scales, which they elevate in rolling themselves into a ball, when they wish to defend themselves against an enemy. All their feet have five toes. Their stomach is slightly divided in the middle part of it, and they have no cœcum. They occur only in the ancient Continent.

[Four or five species are now ascertained, inhabiting Asia and Africa, and varying from three to five feet in length]. The Short-tailed Pangolin (*M. pentadactyla*, Lin.), is the *Phatagan* of Elian. An ungual phalanx has been found, in the Palatinate, of a Pangolin that must have been twenty feet long, or more. (See Cuv., *Oss. foss.* vol. v. part 1, p. 193.)

The third tribe of *Edentata* comprehends animals which M. Geoffroy designates

## MONOTREMATA,

On account of their having but one external opening for all their excretions. Their generative organs present extraordinary anomalies: though without a ventral pouch, they have nevertheless the same supernumerary bones to the pubis as the *Marsupiatæ*; the *vasa deferentia* terminate in the urethra, which opens into the cloaca; the penis, when retracted, is drawn into a sheath, which opens by an orifice near the termination of the cloaca. The only matrix consists of two canals or trunks, each of which opens separately and by a double orifice into the urethra, which is very large, and terminates in the cloaca. As yet naturalists are not agreed as to the existence of their mammæ†; nor whether these animals are viviparous

\* Dabenton has described two small appendages in the *M. didactyla*, which, in strictness, may be considered as cœca. I have satisfied myself, however, that they do not exist in *M. tamandua*.

† M. Meckel considers as such two glandular masses which he found greatly developed in a female *Ornithorynchus*. These M. Geoffroy deems to be rather glands, analogous to those on the flanks of the

or oviparous.\* The singularities of their skeleton are not less remarkable; there being a sort of clavicle common to both shoulders, placed before the ordinary clavicle, and analogous to the *furcula* of birds. Lastly, in addition to five claws on each foot, the males have a peculiar spur on the hind ones, perforated by a canal which transmits a liquid secreted by a gland situated on the inner surface of the thigh: it is asserted that the wounds it inflicts are venomous.† These animals have no external conch to the ear, and their eyes are very small.

The Monotremes are found only in New Holland, where they have been discovered since the settlement of the English. There are two genera known.

THE ECHIDNAS (*Echidna*, Cuv.; *Tachyglossus*, Illig.: sometimes called *Spiny Ant-eaters*).

The elongated slender muzzle of these animals, terminated by a small mouth, and containing an extensible tongue, resembles that of the Ant-eaters and Pangolins, and like them, they feed on Ants. They have no teeth, but their palate is provided with several ranges of small spines, directed backwards. Their short feet have each five long and very stout claws, fitted for burrowing; and all the upper part of their body is covered with spines, as in a Hedgehog, [but much larger and more powerful]. It appears that in the moment of danger, they have also the faculty of rolling themselves into a ball. The tail is very short; stomach ample and nearly globular, and the cæcum of middle size.

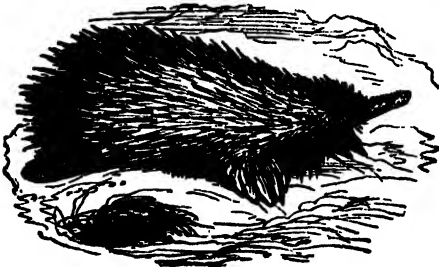


Fig. 52.—Echidna

cept at the bottom of the mouth, where there are two on each side of both jaws, without roots, with flat crowns, and composed, as in the *Orycterope*, of small vertical tubes. Their fore-feet have a membrane which not only connects the toes, but extends beyond the claws: in the hinder, the membrane reaches only to the base of the claws; in addition to their flattened tail, indicate aquatic habits. Their tongue is to a certain extent double; one in the bill beset with villousities; and another at the base of the first, thicker, and furnished anteriorly with two little fleshy points. The stomach is small, oblong, and has its outlet near the entrance; cæcum small; and there are numerous salient and parallel laminae in the course of the intestines. The penis has only two tubercles. These animals inhabit the rivers and marshes of New Holland, and particularly the neighbourhood of Port Jackson.

Two species only are known, one with smooth and thin reddish fur (*O. paradoxus*, Blum.); the other with blackish-brown fur, flat, and somewhat frizzled. These are perhaps only varieties of age.

*Shrews.* [Prof. Owen has since demonstrated them to be mammary, although these animals (like the true *Citacæa*) have no teats or nipples, the lacteal secretion transuding by a number of minute pores.]

\* Travellers have lately asserted, that they have been ascertained to produce eggs. Should this prove to be the case, the Monotremes must, in some sort, be considered as a particular class of animals; but it is much to be wished, that some competent anatomist would minutely describe these eggs, their internal origin, and their development after extrusion. [Prof. Owen has since conclusively shown that the

Two species have been discovered,—the Spiny Echidna (*E. hystris*), completely covered with large spines,—and the Bristly Echidna (*E. setosa*), covered with hair, among which the spines are half-hidden. Some consider the difference as only arising from age.

THE DUCKBILLS (*Ornithorynchus*, Blumenbach; *Platypus*, Shaw).

Muzzle elongated, and at the same time singularly enlarged and flattened, presenting the greatest external resemblance to the bill of a Duck, and the more so as its edges are similarly furnished with small transverse laminae. They have no teeth except

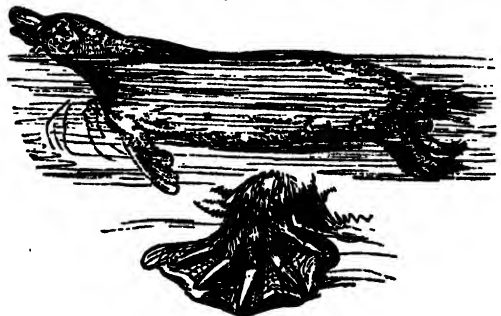


Fig. 53.—The Ornithorynchus.

Monotremes are no oviparous, but must resemble in their reproduction the *Marsupials*. The young have never yet been met with attached to the mamma of their dam, but from the structure of the beak in very young *Ornithorynchi*, which have been found in the burrows, there can be little doubt that the mouth forms, at first, a suctorial disk, adapted to hold on an even flat surface.]

† There is reason to suspect that this statement is without foundation, as the animals never attempt to employ the spur as a weapon of defence.—Ed.

## THE SEVENTH ORDER OF MAMMALIANS.

## PACHYDERMATA.

The *Edentata* terminate the series of unguiculated *Mammalia*, and we have just seen that there are some of them with claws so large, and so enveloping the ends of the toes, as to approximate to the nature of hoofs. Nevertheless, they have still the faculty of bending these toes round various objects, and of seizing with more or less force. The entire absence of this faculty characterizes the *hoofed* animals. Using their feet only as supports, they in no instance possess clavicles. Their fore-arms remain constantly in the state of pronation, whence they are reduced to feed on vegetables. Their forms and mode of life present therefore much less variety than in the *unguiculated* animals, and they can hardly be divided into more than two orders,—those which ruminant, and those which do not; but the latter, which we bring together under the general term *Pachydermata*, admits of some subdivision into families.

The first is that of the *Pachyderms*, which have a proboscis and tusks, or the

## PROBOSCIDEA,\*—

Which are distinguished by having five toes to each foot, very complete in the skeleton, but so enveloped by the callous skin which surrounds the foot, that their only external appearance consists in the nails attached to the extremity of this species of hoof. They have no canines, nor incisors properly speaking; but in the incisive [or intermaxillary] bones are implanted two defensive tusks, which project from the mouth, and frequently attain enormous dimensions. The magnitude of the sockets necessary to hold these tusks renders the upper jaw so high, and so shortens the bones of the nose, that the nostrils in the skeleton are placed near the top of the face: but in the living animal they are prolonged into a cylindrical trunk, composed of several thousands of small muscles variously interlaced, flexible in all directions, endowed with exquisite sensibility, and terminated by an appendage like a finger. This trunk imparts to the Elephant as much address as the perfection of the hand does to the Monkey. It enables him to seize whatever he wishes to convey to his mouth, and sucks up the water he is to drink, which, by the flexure of this admirable organ, is then poured into the throat, thus supplying the want of a long neck, which could not have supported so large a head with its heavy tusks. Within the parietes of the cranium, however, are several great cavities, which render the head lighter: the lower jaw [except in a fossil genus when immature,] has no incisors whatever; the intestines are very voluminous; the stomach simple; cæcum enormous; the mammae, two in number, placed under the chest. The young suck with the mouth and not with the trunk. Only one living genus exists, that of

THE ELEPHANTS (*Elephas*, Lin.),—

Which comprehends the largest of terrestrial Mammalia. The astonishing services performed by their trunk, an instrument at once supple and vigorous, an organ both of touch and smell, contrast forcibly with the clumsy aspect and massive proportions of these animals; and being conjoined to a very imposing physiognomy, have contributed to exaggerate their intellect. After studying them for a long time, we have not found it to surpass that of the Dog, or of several other *Carnaria*. Naturally of a mild disposition, Elephants live in troops conducted by the old males. They subsist wholly on vegetables.

Their distinctive character consists in the grinders, the bodies of which are composed of a certain number of vertical laminae, each formed of a bony substance, enveloped with enamel, and cemented

\* The Proboscideans have various affinities with certain Rodents; grinders being often formed of parallel laminae; and, in the form of lastly, in the magnitude of their incisors [tusks]; and, in their | several of their bones, &c.

together by a third substance, termed the *cortical*; in a word, similar to those we have already seen in the Cavies, and some other Rodents. These grinders succeed each other not vertically, as our permanent teeth replace the milk teeth, but from behind forwards, so that as fast as one tooth becomes worn, it is pushed forward by that which comes after it; hence it happens that the Elephant has sometimes one, sometimes two grinders on each side, or four or eight in all, according to its age. The first of these teeth is always composed of fewer laminae than those which succeed them. It is stated that certain Elephants thus change their molars eight times: their tusks, however, are changed but once.

The Elephants of the present day, covered with a rough skin nearly destitute of hair, inhabit only the torrid zone of the ancient Continent, where hitherto but two species have been discovered.

The Asiatic Elephant (*E. indicus*, Cuv.).—Head oblong, with a concave forehead; the crown of the grinders presenting transverse undulating ridges (*rubane*), which are sections of the laminae which compose them, worn down by trituration. This species has smaller ears than the next one, and has four nails to the hind foot. It is found from the Indus to the Eastern Ocean, and in the large islands to the south of India. From time immemorial this species has been employed as a beast of draught and burden; but has never yet propagated in captivity, though the assertion respecting its modesty and repugnance to copulate before witnesses is utterly devoid of foundation. The females have very short tusks, and in this respect many of the males resemble them.

The African Elephant (*E. africanus*, Cuv.).—Head round, with a convex forehead; very large ears; and grinders presenting lozenge-shaped eminences on their crowns. It appears to have often only three toes on the hind-foot. This species inhabits from Senegal to the Cape of Good Hope. Whether they ascend the eastern coast of Africa,

or are replaced there by the Asiatic species, is not yet ascertained. The tusks of the female are as large as those of the male, and the weapon itself is generally larger than in the preceding. This animal is not now tamed in Africa, though it appears that the Carthaginians employed it in the same way that the inhabitants of India do theirs.

In nearly every part of the two Continents, are found, under ground, the bones of a species of Elephant allied to that of India, but the grinders of which bear straighter and narrower eminences, the sockets for the reception of the tusks are much longer, and the lower jaw is more obtuse. A specimen recently taken from the ice on the coast of Siberia, by Mr. Adams, appears to have been densely covered with hair of two kinds, so that it is possible that this species may have lived in cold climates. It [is termed the Mammoth Elephant (*E. primogenius*, Cuv.), and] has long been quite extinct.

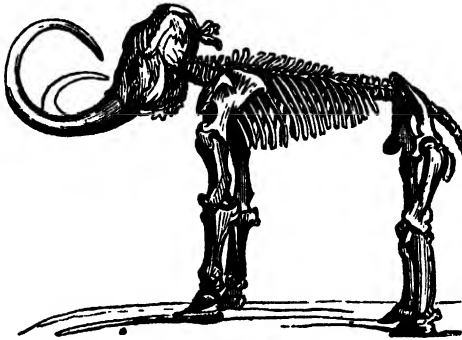


Fig. 64.—Mammoth Skeleton.

The second genus of Proboscideans, or that of

#### THE MASTODONS (*Mastodon*, Cuv.).—

Has been quite destroyed, no species of it being now alive. They had the feet, tusks, trunk, and many other details of conformation the same as the Elephants; but their grinding teeth differed in having large conical tubercles above the gum, which, by detrition, were reduced to disks of various size, that represent sections of the tubercles, (a conformation common to the Mastodon, Hippopotamus, Pig, &c., which has induced the erroneous idea that the first were carnivorous). These grinders, which succeeded each other from behind as in the Elephants, present also so many pairs of points, as the animal was advanced in age. [There are small tusks in the lower jaw of the immature Mastodon, in which state it is the *Tetracaulodon* of Godman.]

The Great Mastodon (*M. giganteum*, Cuv.), in which the tubercles were lozenge-shaped, is the species most celebrated. It equalled the Elephant in size, but with still heavier proportions. Its remains are found in a wonderful state of preservation, and in great abundance through all parts of North America\*: in the Eastern Continent they are of much rarer occurrence.

Narrow-toothed Mastodon (*M. angustidens*).—Much narrower grinders than the preceding, the tubercles of which, when worn down, present trefoil-shaped discs, whence they have been mistaken by some authors for the grinders of the Hippopotamus. This species was one-third less than the Great Mastodon, and much lower on the legs. [Two or three have been confounded under its name.] Its teeth, in certain places, tinged with iron, become of a fine blue when heated, forming what is called the "oriental turquoise."

\* An almost perfect skeleton, made up however of the bones of different individuals, found in the celebrated deposit of "Big-bone lick," is mounted in the Museum of Philadelphia.—Ed.

Our second family is that of the

#### PACHYDERMATA ORDINARIA,—

Which have four, three, or two toes to their feet. Those in which the toes make even numbers have feet somewhat cleft, and approximate the Ruminants in various parts of the skeleton, and even in the complication of the stomach. They are usually divided into two genera.

#### THE HIPPOPOTAMI (*Hippopotamus*, Lin.)—

Have four nearly equal toes to each foot, terminated by little hoofs; six grinders on each side of both jaws, the three anterior of which are conical, the posterior presenting two pairs of points, which, by detrition, assume a trefoil shape; four incisors above and below, those of the upper jaw short, conical, and recurved, the inferior prolonged, cylindrical, pointed, and horizontally projecting; a canine tooth on each side above and below, the upper straight, the lower very large and recurved, those of the two jaws rubbing against each other.

These animals have a very massive body, naked of hair; very short legs, their belly almost touching the ground; an enormous head, terminated by a swollen muzzle, which encloses the apparatus of their large front teeth; a short tail, and small eyes and ears. Their stomach is divided into several sacs. They live in rivers, upon roots and other vegetable substances, and display much ferocity and stupidity.

One living species only is known, the *H. amphibius*, Lin., now confined to the rivers of medial and south Africa. It formerly found its way to Egypt by the Nile, but has long disappeared from that country.

The European freshwater deposits contain the bones of a species of *Hippopotamus* very similar to that of Africa, and also of two or three others successively smaller. (See my *Researches on Fossil Bones*, vol. i.)

#### THE PIGS (*Sus*, Lin.)—

Have two large middle toes to each foot, armed with strong hoofs, and two much shorter lateral ones that hardly touch the ground. Their incisors vary in number, but the inferior always slant forward; the canines project from the mouth and curve upward: muzzle terminated by a truncated snout adapted to turn up the soil, and stomach but slightly divided.

#### THE PIGS, properly so called,—

Have from twenty-four to twenty-eight grinders, the posterior of which are oblong, with tuberculated crowns, the anterior more or less compressed, and six incisors to each jaw.

The Wild Boar (*Sus scropha*, Lin.), which is the parent stock of our Domestic Hog and its varieties, has prismatic tusks that curve outward and slightly upward; the body stout and thick; straight ears; the hair bristly and black: the young ones are variegated black and white. It does great injury to fields in the neighbourhood of forests, by tearing up the ground in search of roots.

The Domestic Pig varies in size and length of limbs, in the direction of its ears, and also in colour; being white or black, sometimes red, and often varied. Every one is acquainted with the usefulness of this animal, on account of the flavour of its flesh, and the length of time it can be preserved by means of salt; the facility with which it is fed; and its great fecundity, which surpasses that of all other animals of its size, the female often producing fourteen young at a litter. The period of gestation is four months, and they produce twice a year. The Hog continues to increase in size for five or six years, is prolific at one, and sometimes lives to twenty. Although naturally savage, they are social, both wild and tame, and know how to defend themselves against Wolves, by forming a circle, and presenting a front in every direction. Voracious and savage, they do not even spare their own young, [at least, if the parent be disturbed soon after their birth]. This species is spread throughout the globe, and none but Jews and Mahometans refuse to eat its flesh. [It appears to be indigenous only, however, to Europe and Asia, extending to the Peninsula of Hindostan: the Chinese breed is probably a distinct species, though it commingles freely with the other.]

The Masked Boar (*S. larvatus*, F. Cuv.; *S. africanus*, Schreber; *Sanglier de Madagascar*, Daub.)—Tusks like the Common Hog; but on each side of the muzzle, near the tusks, is a large tubercle, somewhat like the nipple of a woman, supported by a bony prominence, which imparts a singular physiognomy to the animal. It inhabits Madagascar and the south of Africa.

The Babyrousa (*Sus babyrousa*, Buff. Supp.)—Longer and more slender legs than the others, with slender tusks turned vertically upwards, those of the upper jaw inclining spirally backward. It inhabits several islands of the Indian Archipelago. [The Papuan Hog (*S. papuensis*) is another distinct species from New Guinea.]

From the Pigs require to be separated

THE WART-HOGS (*Phacochæres*, F. Cuv.),—

The grinders of which are composed of cylinders, cemented together by a cortical substance, almost like the transverse laminae of the Elephant, and like them succeeding each other from behind. Their skull is singularly large, the tusks rounded, directed laterally upward, and of a frightful magnitude; and on each of their cheeks hangs a thick fleshy lobe, which completes the hideousness of their aspect. They have but two incisors above and six below.

The individuals received from Cape Verd (*S. africanus*, Gm.) have generally the incisive teeth complete; those which arrive from the Cape of Good Hope (*S. æthiopicus*, Gm.) scarcely show any trace of them, although vestiges are sometimes found within the gum. This difference may perhaps arise from age, which has worn down the teeth of the latter, or it may indicate a specific diversity, the more especially as the heads of those from the Cape are rather larger and shorter.

There is still better reason to separate from the genus of Pigs—

THE PECCARIES (*Dicotyles*, Cuv.),—

Which have certainly grinders and incisors very like those of the Pigs properly so called, but their canines, directed as in the generality of the class, do not project from the mouth, besides which they want the external toe to their hind-feet. They have no tail, and upon the loins is a glandular opening from which a fetid humour exudes. The metacarpal and metatarsal bones of their two great toes are soldered into a kind of cannon-bone, as in the Ruminants; with which their stomach, also, divided into several sacs, presents a marked analogy. It is a singular fact, that the aorta of these animals is often found very much enlarged, but not always in the same part, as if they were subject to a kind of aneurism.

There are two species known, both inhabitants of South America, which were first distinguished by Azzara. Linnaeus confounded them together under the name of *Sus tajacu*.

The Collared Peccary (*D. torquatus*, Cuv.).—Hair annulated grey and brown; a whitish collar, stretching obliquely from the angle of the lower jaw over the shoulder. Size half that of the Wild Boar.

The White-lipped Peccary (*D. labiatus*, Cuv.).—Larger; and brown, with white lips.

Here may be placed a genus now unknown among existing animals, which we have discovered, and named

## ANOPILOTHERIUM, Cuv.,—

And which presents the most singular relations with the different tribes of *Pachydermata*, approximating, in some respects, to the order *Ruminantia*. Six incisors to each jaw, four canines almost similar to the incisors and of even length with them, and seven molars on each side above and below, form a continuous series without any intervening space, a disposition of the teeth seen elsewhere in Man only. The four posterior molars on each side resemble those of the Rhinoceroses, the Damans, and Palæotheriums; that is to say, they are square above, and form double or triple crescents below. The feet, terminated by two great toes, as in the Ruminants, are yet different in the circumstance of the metacarpal and metatarsal bones remaining always separated, or being never united into a cannon-bone. The construction of their tarsus is the same as in the Camel.

The bones of this genus have hitherto only been found in the gypsum quarries near Paris. We have already recognized five species: one the size of a small Ass, with the low form and long tail of an Otter (*A. commune*, Cuv.), the fore-feet of which have a small internal accessory toe; another of the size and slender form of the Gazelle (*A. medium*); a third no bigger and with nearly the same proportions as a Hare, with two accessory toes to the sides of its hind-feet, &c. (See my *Ossemens fossiles*, tom. iii.)

The ordinary Pachydermata which have not cloven feet comprehend, in the first place, three genera, the molar teeth of which are very similar, there being seven on each side with square crowns, and various prominent lines, and seven in the lower jaw, the crowns of which form double crescents, and the last of all a triple one: their incisors, however, vary.

THE RHINOCEROSSES (*Rhinoceros*, Lin.).—

In this respect differ from one another. They are large animals, with each foot divided into three toes, and the nasal bones of which, very thick and united into a kind of arch, support a solid horn, which adheres to the skin, and is composed of a fibrous and horny substance, resembling agglutinated hairs.

They are naturally stupid and ferocious; frequent marshy places; subsist on herbage and the branches of trees; have a simple stomach, very long intestines, and great cæcum.

The Indian Rhinoceros (*RA. indicus*, Cuv.).—In addition to its twenty-eight grinders, this species has two stout incisive teeth in each jaw, together with two other intermediate smaller ones below, and two still more diminutive outside of its upper incisors. It has only one horn, and its skin is remarkable for the deep folds into which it is thrown behind and across the shoulders, and before and across the thighs. It inhabits the East Indies, and chiefly beyond the Ganges.

The Javanese Rhinoceros (*RA. javanicus*, Cuv.).—with the great incisors and single horn of the preceding, has fewer folds in the skin, though one of them on the neck is larger; and, what is remarkable, the entire skin is covered with square angular tubercles, [as is also the case, to a partial extent, in the preceding; from which it further differs in having a comparatively slender head].

The Sumatran Rhinoceros (*RA. sumatrensis*, Cuv.).—with the same four great incisors as the foregoing, has no folds in the skin, which is besides hairy, and there is a second horn behind the first.

The African Rhinoceros (*RA. africanus*, Cuv.) [or rather Rhinoceroses, three species of them being now ascertained].—Two horns as in the preceding; and no folds of the skin, nor any incisor teeth, the molars occupying nearly the whole length of the jaw. This deficiency of incisors might warrant a separation from the others. [The Great Rhinoceros (*RA. sinensis*, Burchell), which considerably exceeds in size any of the others, is further distinguished by its pale colour, its very long and straight anterior horn, and remarkably short hind one, and particularly by the form of its upper lip, which is not capable of elongation, and a certain degree of prehension, as in all the others; it is the most gregarious of any, and also the most inoffensive, frequenting the open karroos. The common Cape Rhinoceros (*RA. africanus* or *capensis*) is darker, with also unequal horns, the posterior being shorter; and the Kettloa Rhinoceros (*RA. kettloa*), recently discovered by Dr. Smith, is an animal of solitary habits, with horns of equal length, reputed to exceed the rest in ferocity.\*]

There have been found, under ground, in Siberia and different parts of Germany, the bones of a double-horned Rhinoceros, the skull of which, besides being much more elongated than in any known existing species, is further distinguished by a bony vertical partition that supported the bones of the nose. It is an extinct animal; but of which a carcass, almost entire, exposed by the thawing of the ice on the banks of the Vilhovi in Siberia, showed to have been covered with tolerably thick hair. It is possible, therefore, that it inhabited northern climates, like the fossil Elephant.

More recently there have been disinterred, in Tuscany and Lombardy, other Rhinoceros bones, which appear to have belonged to a species allied to the African. Some have been found, in Germany, with incisors like the Asiatic species; and lastly, there have been discovered, in France, the bones of one which announce a size scarcely larger than a Pig. [It appears that several of the fossil species were destitute of the nasal horn.]

#### THE DAMANS (*Hyrax*, Hermann)—

Were long placed among the *Rodentia*, on account of their very small size; but, on examining them carefully, it will be found that, excepting the horn, they are little else than Rhinoceroses in miniature; at least they have quite similar molars; but the upper jaw has two stout incisors curved downwards, and, during youth, two very small canines; the inferior four incisors, without any canines. They have four toes to each of their fore-feet, and three to the hind-feet, all, excepting the innermost posterior, which is armed with a crooked and oblique nail, terminated by a kind of very small, thin, and rounded hoof. The muzzle and ears are short: they are covered with hair, and have only a tubercle in place of a tail. The stomach is divided into two sacs; their cæcum is very large, and the colon has several dilatations, and is also furnished with two appendages about the middle, analogous to the two cæca of birds.

Only one species is known, the size of a Rabbit, and greyish; it is not uncommon in rocky places throughout Africa, where it is much preyed on by rapacious birds, and it also appears to inhabit some parts of Asia; at least we cannot perceive any certain difference between the *Hyrras capensis* and *H. syriacus*. [Five, if not six, are now conclusively established; one of which, indigenous to South Africa, even ascends trees.]

#### THE PALÆOTHERIUM, Cuv.—

Is another lost genus: with the same grinders as the two preceding, six incisors and two canines to each jaw as in the Tapirs, and three visible toes to each foot, it combined a short fleshy trunk, for the muscles of which the bones of the nose were shortened, leaving a deep notch underneath. We have discovered the bones of this genus, mingled with those of the Anoplotherium, in the gypsum quarries in the environs of Paris, and they occur in several other parts of France; [also, with those of the *Charopotamus*, *Dichobune*, &c., other lost genera of *Pachydermata*, in the Binstead quarries of the Isle of Wight, England].

\* Previous to discovering this species, a fine specimen of which is deposited in the British Museum, Dr. Smith received information, from the natives, of the existence of five sorts of these animals in South

Africa, which are distinguished there by separate names: one of them is stated to have only a single horn.—Ed.



Eleven or twelve species are already known. At Paris alone, we have found one the size of a Horse, another that of a Tapir, and a third of a small Sheep: the bones of a species nearly equalling the Rhinoceros in size have been met with in the neighbourhood of Orleans. These animals appear to have frequented the borders of lakes and marshes, for the deposits which enclose their remains contain also those of freshwater shells. (See my *Ossemens fossiles*, tom. iii.)

#### THE LOPHIODONS—

Form another extinct genus, which appears to have been closely allied to the preceding one; but the inferior incisors of which exhibit transverse ridges. Ten or twelve species have been exhumed from the same ancient freshwater deposits that have yielded the *Palseotheriums*.

To these last genera succeeds that of

#### THE TAPIRS (*Tapir*, Lin.),—

Wherein the twenty-seven molars, before they are worn, present transverse and sagittular ridges; there are six incisors and two canines in each jaw, separated from the molars by a wide interval. The nose assumes the form of a short fleshy trunk; and the fore-feet have each four toes, the hinder but three.

For a long while only one species was known, that of America (*T. americanus*, Lin.), which is the size of a small Ass, with a brown and almost naked skin, a short tail, and fleshy neck, that forms a crest at the nape. It is common in humid places and along the rivers of the warm parts of America, where its flesh is eaten. The young are spotted with white like the fawns of a Stag. Within a few years, a second species has been discovered in the Eastern Continent (*T. indicus*), of larger size than the other, and brown-black, with the back greyish white. It inhabits the forests of the Malay peninsula, the island of Sumatra, &c. Still more recently, Dr. Roulin has discovered in the Cordilleras a third species, of a black colour, and covered with thick hair; the bones of its nose are more elongated, a particular in which it somewhat approximates the *Palseotheriums*.

There have also been found in Europe some fossil bones of Tapirs, and, among the rest, those of a gigantic species approaching the Elephant in size (*T. giganteus*, Cuv., *Oss. foss.*) "The lower jaw of this huge animal has been obtained by M. Schleyermacher, and proves to possess enormous canines, which must have projected from the mouth, [and are directed downwards]; it should therefore form a separate genus. Its size may have been greater than that of the Elephant by one half. [A more perfect head of this extraordinary species, the largest of the *Pachydermata* hitherto discovered, has been lately disintombed in Germany, and described by Prof. Kaup. With two other species, successively smaller, it now composes the genus *Deinotherium*, the members of which are suspected by Blainville and other anatomists to have been aquatic animals, destitute of posterior extremities, like the Dugongs and Manati.]

The third family of *Pachydermata*, or of hoofed animals that do not ruminates, consists of the

#### SOLIDUNGULA,

Or quadrupeds with only one apparent toe and a single hoof to each foot, although beneath the skin, on each side of their metacarpus and metatarsus, there are appendices (*stylets*) which represent two lateral toes. But one genus of them is known, that of

#### THE HORSES (*Equus*, Lin.).

There are six incisors to each jaw, which, during youth, have their crowns furrowed with a groove, and six molars on each side above and below, with square crowns, marked by laminae of enamel which penetrate them, with four crescents, besides which there is a small disk on the inner border of those above. The males have in addition two small canines in their upper jaw, and sometimes in both, which are always wanting in the females. Between these canines and the first molar, there is a wide space which corresponds with the angle of the lips, where the bit is placed, by which alone Man has been enabled to subdue these powerful quadrupeds. Their stomach is simple and middle-sized; but their intestines are very long, and cæcum enormous. The teats are situate between the thighs.

The Horse (*E. caballus*, Lin.).—This noble associate of Man in the chase, in war, and in the labours of agriculture, arts and commerce, is the most important and carefully tended of domestic animals. It does not appear to exist in the wild state, excepting in those countries where the offspring of tame individuals have been suffered to run wild, as in Tartary and America, where they live in troops, each conducted and defended by an old male. The young males, expelled as soon as they have attained the age of puberty, follow the troop at a distance, until they have attracted some of the younger mares.

In a state of servitude, the colt continues suckling for six or seven months, and the sexes are separated at two years; at three they are first handled and accustomed to some management, and at four saddled and mounted, at which age they can propagate without injuring themselves. The period of gestation is eleven months.



A Horse's age is known by his incisors. The middle teeth begin to appear about fifteen days after birth; and at two years and a half the middle ones are replaced; at three and a half the two next follow; and at four and a half, the outermost or corner teeth. All these teeth, with originally-indented crowns, lose by degrees this character by detrition. At seven and a half or eight years, the depressions are completely effaced, and the Horse is no longer marked.

The inferior canines appear at three years and a half, the superior at four years; they remain pointed until the sixth, and at ten begin to peel away.

The life of a Horse seldom extends beyond thirty years. Every one knows how much this animal varies in size and colour. The principal races even exhibit sensible differences in the form of the head, and in their proportions, each being specially adapted for some particular mode of employment.

The most beautiful and swift are the Arabs, which have contributed to perfect the Spanish breed, and with the latter to form the English: the stoutest and strongest are from the coasts of the North Sea; and the most diminutive from the north of Sweden and Corsica. Wild Horses have a large head, frizzled hair, and ungraceful proportions. [If the figure of Pallas be correct, of the Wild Horse of northern Asia, it is doubtful, from the length of the ears and some other characters, whether a distinct species intermediate to the true Horse and the following be not represented. M. Berres suspects that a species of *Equus* now extinct is represented on the celebrated mosaic of Palestrina. Bones of this genus are not uncommon in the older tertiary strata, and have even been found in those of South America.

The *Dægguetal* (*Equus hemionus*, Pallas).—A distinct species, intermediate in its proportions to the Horse and Ass, which lives in troops in the sandy deserts of Central Asia. Colour isabelle, with black mane and [broad] dorsal line; a terminal black tuft to the tail. This was probably the Wild Mule of the ancients.

The Ass (*E. asinus*, Linn.).—Known by its long ears, the tuft at the end of its tail, and the black line crossing the dorsal one over its shoulders, which is the first indication of the transverse stripes that occur in the following species. [Some of the young have obscure cross-bands on the legs.] Originally from the vast deserts of the interior of Asia, the Ass is still found there free and unreclaimed, in numerous troops, which migrate north and south according to the season: hence it does not thrive in countries too much to the north. Its patience, sobriety, hardy constitution, and the services which it renders to the poor, are well known to every one. The harshness of its voice, or *bray*, is occasioned by two small peculiar cavities situate at the bottom of the larynx.

The Zebra (*E. zebra*, Linn.).—Nearly the form of the Ass, and everywhere transversely striped with black and white in a regular manner. It is indigenous to the whole south of Africa. We have known a female Zebra produce successively with the Horse and the Ass.

The Couagga (*E. quaccha*, Gmel.), resembles the Horse more than the Zebra, but inhabits the same country as the latter. Its coat is brown on the neck and shoulders, transversely striped with whitish; the crupper reddish-grey, and tail and legs whitish. Its name expresses the sound of its voice, which is not unlike the bark of a Dog.

The Onagga or Daw (*E. montanus*, Burchell).—Another African species, inferior [?] in size to the Ass, but with the handsome form of the Couagga, and of an isabelle colour, striped with alternately broader and more narrow black markings on the head, neck, and body. The hinder stripes are disposed obliquely forward, and the legs and tail are white.

## THE EIGHTH ORDER OF MAMMALIANS,—

### RUMINANTIA,—

Is, perhaps, the most natural and the best determined of the whole class, for all the species which compose it appear to have been constructed on the same model, and the Camels alone present some inconsiderable exceptions to the general characters of the group.

The first of these characters is that of having no incisors in the upper jaw, while the inferior has always eight, [the two outermost of which represent canines, as can be easily shown]. They are replaced above by a callous pad. Between the incisors and the molars is a wide space, where, in some genera, there are one or two canines.\* The molars, almost always six in number above and below, have their crowns marked with two double crescents, the convexity of which is turned inwards in the upper, and outwards in the lower jaw.

The four feet are each terminated by two toes, and by two hoofs, which present a flat surface to each other, appearing as though a single hoof had been cleft: hence the names that have been applied to these animals, of cloven-footed; bifurcated, &c.

Behind the hoof there are always two small spurs, which are vestiges of lateral toes. The

\* Though acquainted with all the subdivisions of Ruminantia, we have never seen more than one canine in any animal whatever; and in the Camels, wherein the inferior canine has been recognised as such, there are never more than six lower incisors.—Ed.

two bones of the metacarpus and metatarsus are united into a single one, designated the *cannon bone*; but in certain species there are also vestiges of lateral metacarpal and metatarsal bones.

The name *Ruminantia* intimates the singular faculty possessed by these animals, of masticating their food a second time, it being returned to the mouth after the first deglutition. This faculty depends on the structure of their stomachs, which are always four in number, the first three of which are so disposed that the food may enter into either of them, the cesophagus terminating at the point of communication.

The first and largest stomach is named the *paunch*; it receives a large quantity of vegetable matters coarsely bruised by the first mastication. From this it passes into the second, termed the *honey-comb bag*, the parietes of which are laminated like the cells of Bees. This second stomach, very small and globular, seizes the food, and moistens and compresses it into little pellets (or *cuds*), which afterwards successively return to the mouth to be rechewed. The animal remains at rest during this operation, which lasts until all the herbage first taken into the paunch has been subjected to it. The aliment thus remasticated descends directly into the third stomach, termed the *feuillet*, on account of its parietes being longitudinally laminated somewhat like the leaves of a book, from which it descends into the fourth or *caillette*, the coats of which are wrinkled, and which is the true organ of digestion, analogous to the simple stomach of animals in general. In the young of the ruminants, while they continue to subsist on the milk of the mother, the *caillette* is the largest of the four. The paunch is only developed by receiving great quantities of herbage, which finally give it its enormous volume. These animals have the intestinal canal very long; but there are few enlargements in the great intestines. The cœcum is likewise long and tolerably smooth. Their fat hardens more by cooling than that of other quadrupeds, and even becomes brittle. It is commonly termed *tallow*. The udder is placed between the thighs.

The Ruminants, of all animals, are those which are most useful to Man. They furnish him with food, and nearly all the flesh that he consumes. Some serve him as beasts of burden, others with their milk, their tallow, leather, horns, and other products.

The two first genera are without horns.

#### THE CAMELS (*Camelus*, Lin.),—

Approximate the preceding order rather more than the others. They have not only always canines in both jaws, but have also two pointed teeth implanted in the intermaxillary bones, six inferior incisors, and from eighteen to twenty molars only; peculiarities which, of all the *Ruminantia*, they alone possess, besides which the scaphoid and cuboid bones of the tarsus are separated. Instead of the great hoof, flat at its inner side, which envelopes the whole inferior portion of each toe, and which determines the figure of the ordinary cloven foot, they have but one small one, which only adheres to the last phalanx, and is symmetrically formed like the hoofs of the *Pachydermata*. Their tumid and cleft lip, their long neck, projecting orbits, weakness of the crupper, and the disagreeable proportions of their legs and feet, render them in some sort deformed; but their extreme sobriety, and the faculty they possess of passing several days without drinking, cause them to be of the highest utility.

It is probable that this last faculty results from the great masses of cells which cover the sides of their paunch, in which water is constantly retained or produced. The other Ruminants have nothing of the kind.

Camels urinate backward, but the direction of the penis changes during copulation, which is effected with considerable difficulty, and while the female lies down. In the rutting season a fetid humour issues from the head.

#### THE CAMELS, properly so called,—

Have the two toes united below, almost to the point, by a common sole, and humps of fat upon the back. They are large animals of the Eastern Continent, of which two species are known, both of them completely domesticated.\*

\* Pallas states, on the authority of the Beggars and Tartars, | may remark that the Calmucks are in the habit of liberating all sorts that there are wild Camels in the deserts of Central Asia; but we | of animals from a religious principle.

The Bactrian or Two-humped Camel (*C. bactrianus*, Lin.),—originally from Central Asia, and which descends much less to the south than

The Arabian or One-humped Camel (*C. dromedarius*, Lin.), which is spread from Arabia into all the north of Africa, and great part of Syria, Persia, &c.

The first is the only one employed in Turkostan, Thibet, &c.; and is sometimes led as far as Lake Baikal. The second is well known, in consequence of the necessity of employing it in crossing the great Desert, being the only means of communication between the countries on its borders.

The Two-humped Camel walks less painfully than the other on humid ground; and is also larger and stronger. Previous to renewing its coat it sheds the whole of its hair. It is the One-humped Camel that is the most abstemious. The *Dromedary* is merely a lighter variety of it, better fitted for expedition.

The flesh and milk of the Camel serve for food, and its hair for garments, to the people who possess it. In rocky or stony countries both species are useless. [Buffon considered the humps and callous pads on the legs of these animals as marks of servitude: on the contrary, they are admirable instances of direct adaptation to their indigenous locality. The enlargement and convex soles of their feet are expressly fitted for treading on loose yielding sand; and their humps are provisions of superabundant nutriment, which are gradually absorbed and disappear on the occasion of a scarcity of other food, as is particularly observed at the end of a long journey. By resting on their callosities, they are enabled to lie down and repose on a scorching surface; and finally, the abundant supply of fluid in their stomach is too obvious a provision, in reference to their peculiar requirements, to need even this passing allusion.]

#### THE LAMAS (*Auchenia*, Illiger),—

Have their two toes separate, and are without humps. Only two clearly distinct species are known, both from the New World, and much smaller than the preceding.

The Lama, which, in its wild state, is termed *Guanaco* (*Camelus llama*, Lin.).—As large as a Stag, with dense hair of a chestnut-colour, but varying when the animal is domesticated. It was the only beast of burden which the Peruvians possessed at the time of the conquest. It can carry a hundred and fifty pounds, but can only make short journeys. The *Alpaca* is a variety with long woolly hair.

The Vicugna (*Cam. vicugna*, Lin.).—Size of a Sheep, and covered with fulvous wool, of admirably fine texture, and of which valuable stuffs are manufactured. [The Lamas are mountain animals, peculiar to the Andes. M. Alc. d'Orbigny, who has long resided in their native country, distinguishes four species of them, viz., the Lama and Alpaca, which have been completely reduced to servitude, and the Guanaco and Vicugna, which constantly refuse to copulate with the others.]

The bones of an animal related to the Lamas, but which must have equalled the Camels of the eastern hemisphere in stature, and which had three toes to the fore-feet, have lately been recovered by Mr. Darwin in Paraguay: the *Macrauchenia*, Owen].

#### THE MUSKS (*Moschus*, Lin.),—

Are very much less anomalous than the Camels, differing only from ordinary Ruminants in the absence of horns, by a long canine on each side of the upper jaw, which projects beyond the mouth in the males, and lastly, by having a slender peronæum, which is not present even in the Camel. They are remarkable for their elegance and lightness.

The Pouched Musk (*M. moschiferus*, Lin.), is the most celebrated species. Size that of a Roe, and almost without tail; it is completely covered with hairs, so coarse and brittle that they might almost be termed spines: what particularly distinguishes it, however, is the pouch situate before the prepuce of the male, which contains an odorous substance, well known in medicine and perfumery by the appellation *musk*. This species appears confined to that rugged and rocky region from which most of the Asiatic rivers descend, and which extends between Siberia, China, and Thibet. Its habits are nocturnal and solitary, and timidity extreme. It is in Thibet and Tonquin that it yields the best musk; that of the north being almost inodorous. [The difference more probably arises from the amount of adulteration, which is practised to a vast extent.]

The other Musks have no musk-pouch, [and constitute the *Tragulæ* of Bennett]. They inhabit the warm parts of the eastern hemisphere, and are the smallest and most elegant of the *Ruminantia*. Such are *M. pygmaeus*, Buff.; *M. memina*, Schreb.; and *M. javanicus*, Buff.

All the other Ruminants, at least of the male sex, have two horns; that is to say, two prominences of the frontal bones, more or less long, which occur in no other group of animals.

In some, these prominences are covered with an elastic sheath, formed as it were of agglutinated hair, which continues to increase by layers during life. The name of *horn* is applied to the substance of this sheath, and the sheath itself is termed the *core*. The prominence which it envelopes grows with it during life, and never falls. Such are the horns of cattle, as Oxen, Sheep, Goats, and Antelopes.

In others, the prominences are only covered with a hairy skin, continuous with that of the head: these prominences do not fall; and the Giraffes afford the only example.

Finally, in the genus of Stags, the prominences, covered for a while with a hairy skin like the other parts of the head, have at their base a ring of bony tubercles, which, as they enlarge, compress and obliterate the nutritive vessels of that skin, [commonly termed the velvet]. It becomes dry, and is thrown off: the bony prominences, being laid bare, at the expiration of a certain period separate from the skull to which they were attached; they fall, and the animal remains defenceless. Others, however, are reproduced, generally larger than before, which are destined to undergo the same fate. These horns, purely osseous, and subject to periodical changes, are styled *antlers*.

#### THE STAGS (*Cervus*, Lin.).—

Are consequently ruminants which have heads armed with antlers; but, if we except the Rein Deer, the females in no instance possess them, [save in rare individual cases\*]. The substance of these antlers, when completely developed, is that of a dense bone without pores or internal cavity: their figure varies greatly according to the species, and even in each species at different ages. These animals are extremely fleet; live mostly in forests; and feed on grass, the leaves and buds of trees, &c.

Those species which have antlers either wholly or partially flattened may be first distinguished; such as—

The Elk, or Moose Deer (*C. alces*, Lin.).—As large as a Horse, and sometimes larger; very high upon the legs; with a swollen cartilaginous muzzle, and a sort of goitre, or variously shaped pendulous swelling, under the throat; hair always very stiff, and of an ash-colour, more or less dark. The antlers of the male, at first dagger-shaped, and then divided into narrow slips, assume, at the age of five years, the form of a triangular blade, denticulated on its outer edge, and borne on a pedicle. They increase with age, so as to weigh fifty or sixty pounds, and to have fourteen branches on each horn. The Elk lives in troops in the marshy forests of the north of both continents, and its skin forms valuable leather.

The Rein Deer (*C. tarandus*, Lin.).—Size of a Stag, but with shorter and stouter limbs; both sexes have antlers, divided into several branches, at first slender and pointed, and finally terminating with age in broad denticulated palms: the hair, brown in summer, becomes almost white in winter. It is peculiar to the glacial regions of both continents, and is the animal so celebrated for the services which it renders to the Laplanders, who have numerous

herds of them, which in summer they lead to the mountains, and in winter bring back to the plains: it is their only beast of burden and draught, its milk and flesh serve them for food, its hide for clothes, &c.

The Fallow Deer (*C. dama*).—Less than the Stag, and blackish-brown in winter, fulvous spotted with white, in summer; the buttocks always white, bordered on each side with black: tail longer than that of the Stag, black above and white below. The horn of the male is round at base, with a pointed antler, and throughout the rest of its length flattened, with its outer edge denticulated. After a certain age it shrinks, and splits irregularly into several slips. This species, the *Platyceros* of the ancients, has become common throughout Europe, but appears to have been originally from Barbary. A blackish variety without spots [even in the fawns] is not uncommon.

The species with round antlers are more numerous. Those of temperate climates change colour, more or less, with the seasons.

The Common Stag, or Red Deer (*C. elephas*, Lin.).—Fulvous-brown, with a black dorsal line, and on each side of it a series of small pale fulvous spots, in summer; uniform greyish-brown in winter: the crupper and tail pale fulvous at all seasons. It is indigenous to the forests of all Europe, and of the temperate parts of Asia. The antlers of the male are round, and appear in the second year, at first dagger-shaped, and then with branches on



Fig. 66.—Red Deer.

their inner side, which increase in number with age; they are crowned finally with a sort of palmation, having

\* There is the head of a female Roe, with antlers, in the Museum of the Royal College of Surgeons, London. The connection of these defences, however, with the sexual organs is remarkable. They do not grow in emaciated individuals; and the resting season immediately follows their development. In *Zin. Zoon.* vol. II. p. 305, an

instance is recorded of a Doe with only a single horn, resembling that of a three-year-old Buck; and on dissection, the ovary of the same side was found to be schirous. After attaining their maximum of development, the antlers of these animals decrease, in old age, at each successive renewal.—Ed.

many points. When very old, the Stag becomes blackish, and the hairs on the neck lengthen and become erect. The antlers are shed in spring, the old ones losing them first; and are reproduced in summer, during the whole of which period the males associate separately. When they are grown again, the rutting season commences, which lasts three weeks, at which time the males become furious. Both sexes unite in vast herds  $\oplus$  pass the winter. The hind carries eight months, and brings forth in May; the fawn is fulvous, spotted with white.

The Canadian Stag, or *Wapiti*; *Elk* of the Anglo-Americans (*C. canadensis*, Gm.; *C. strongyloceros*, Schreb.)—A fourth larger than our Stag, and nearly of the same colour, but with the disk of the crupper larger and paler, the horns equally round, but more developed, and without a palm. Inhabits all the temperate parts of North America.

The Virginian Stag, or *Deer* of the Anglo-Americans (*C. virginianus*, Gm.).—Less than ours, and more elegantly formed; the muzzle more pointed; of a pale fulvous in summer, reddish-grey in winter; the under part of the throat and tail white at all seasons. Antlers shorter than in the European species, and very differently formed.



Fig. 86.—*Cervus macrourus*.

antlers, and short antlers borne upon pedicles, covered with hair on the forehead: such are the Muntjac, or Kijang, (*O. muntjac*, Gm.), which is found in small herds at Ceylon and Java, the *C. philippinae*, H. Smith, *C. moschatus*, Id., &c.

#### THE GIRAFFE (*Camelopardalis*, Lin.).—

Is characterized by conical horns in both sexes, that are always covered with a hairy skin, and never fall. The bony nucleus of them is articulated during youth to the frontal bone by a suture. In the middle of the forehead, there is an eminence or third horn, broader and much shorter, but equally articulated by suture. This animal is in other respects one of the most remarkable that exist, on account of the great length of its neck and the disproportionate extension of its fore-legs.\*

Only one species is known (*C. girafa*, Lin.), confined to the deserts of Africa, which has short hair, marked with angular fulvous spots on a greyish ground, and a slight mane on the hind-neck. It is the tallest of all animals, its head being frequently raised eighteen feet from the ground. Its disposition is gentle, and it feeds on leaves.

#### THE RUMINANTS WITH HOLLOW HORNS—

Are more numerous than the others, and we have been necessitated to divide them into genera upon characters of trivial import, derived from the form of the horns, and the proportions of the various parts. To these M. Geoffroy has advantageously added those afforded by the substance of the frontal prominence, or the bony nucleus of the horn.

\* The Giraffe is essentially a modified Deer, with persistent horns. Large gall bladder, like the Antelope; whereas no trace of this Of three dissected, however, by Prof. Owen, one proved to possess a receptacle existed in either of the others, as in the Deer tribe.—Ed

The species inhabiting warm climates do not change colour. There are several in South America, at present but imperfectly determined; as *C. paludosa*, Desm.; *C. campestris*, F. Cuv.; *C. nemoralis*, H. Smith, &c. There are also several in the East Indies; as the Axis (*C. axis*, Lin.), permanently spotted with pure white, and which is indigenous to Bengal, but propagates easily in Europe: also *C. aristoteli*, Cuv., which, with long hairs on the neck and throat, and inhabiting the north of India, must correspond with the *Hippelaphus* of Aristotle, &c., &c. Several of these have canine teeth.

The Roe (*C. capreolus*, Lin.),—with but two tines to its antlers: of a greyish-fulvous; the buttocks white; no infra-orbital sinuses, and scarcely any tail. Some individuals are very bright russet, and others blackish. This species lives in pairs in the elevated forests of temperate Europe, sheds its antlers at the close of autumn, renews them in winter, undergoes the rut in November, and remains with young five months and a half. Its flesh is much more esteemed than that of the Stag. There are none in Russia. The Tartarian Roe (*C. pygargus*, Pallas) is larger, with longer hair, and horns more spinous at their base. It inhabits the high grounds beyond the Volga. There are also some Roes in America, the antlers of which always remain simple, or without tines; as *C. rufus*, F. Cuv., with canines in both jaws, *C. nemorivagus*, F. Cuv., and *C. simplicicornis*, H. Smith.

In India there are some small species which might be separated from the other Roes, having sharp canines, and short antlers borne upon pedicles, covered with hair on the forehead: such are the Muntjac, or Kijang,

THE ANTELOPES (*Antilope*, Lin.).—

Have the substance of the bony nucleus of the horn solid, with neither pores nor cavity, like the antlers of the Stag. They also further resemble the Stag in possessing infra-orbital sinuses, in the slenderness of their form, and speed of foot. They compose a very numerous genus [consisting now of more than seventy well-ascertained species], which we have been compelled to subdivide principally after the shape of the horns.

a. Horns annulated, with a double curvature; the points forward, or inward and upward, [in other words, annulated and lyrate]; also placed forward on the head, above the eye: the muzzle and around the nostrils hairy. This is the most characteristic section of the genus, and the species composing it may be distinguished by the term *Gazelles*.]

The Numidian Gazelle (*A. dorcas*, Lin.).—Round, thick, and black horns, with the size and graceful shape of the Roe: pale fulvous above, white below; a brown band along each flank, a tuft of hair on each knee, and a deep pouch on each groin. Inhabits the north of Africa in innumerable herds, which form a circle when attacked, presenting horns on every side. Is the ordinary prey of the Lion and the Panther. The soft expression of its eye supplies the Arabic poets with many images.

[To this division belong also the *A. euchore*, *Kevella*,\* *Bennettii*, *arabica*, *corianna*, *Soëmmerringii*, *mhorr*, *dama*, *rusticollis*, *melampus*, and *pygargus*, which last seems to tend through *A. caama*, *bubalus*, &c., to the Gnu. The author likewise includes *A. gutturosa*, Pallas, the *Hoang-yang* or *Yellow Goat* of the Chinese, herds of which inhabit the arid plains of Central Asia, and the *A. satga*, Pal., or *Colus* of Strabo, a European animal, indigenous to the south of Poland and Russia; it is as large as a Fallow Deer, and fulvous in summer; whitish-grey in winter. Its cartilaginous, thick, and vaulted muzzle, with very expanded nostrils, obliges it to retrograde in feeding. The herd sometimes consists of more than ten thousand individuals. [We are inclined to approximate to the Saiga a remarkable species from Northern India, the Chiru (*A. Hodgsoni*, Abel); it is somewhat less than the Fallow Deer, of a whitish colour, with the face and front of the limbs black; horns nearly straight, or but slightly lyrate, and remarkably long and slender, rising abruptly from the forehead. Among the true Gazelles, may be particularly noticed the Springer, or *Spring-bok* (*A. euchore*) of the Cape colonists, so celebrated for occasionally

visiting, during seasons of drought, the cultivated lands of South Africa in innumerable herds, which devastate wherever they pass.] It is larger than the Numidian Gazelle (*A. dorcas*), and nearly of the same form and colour; is distinguished by a fold of skin on the crupper, clothed with long white hairs, which opens and enlarges at every bound the animal takes. [The *A. Soëmmerringii* is still larger, and of a delicate pale buff-yellow or *nankeen* colour, the hairs singularly disposed in zig-zag patches, imparting a peculiar waved appearance.]

b. Horns annulated, and with a triple [spiral] curve.

The Indian Antelope (*A. cervicapra*, Lin.).—Still very like the Gazelles, but the horns have a triple flexure. [Colour variable, black or different shades of brown, relieved with white around the eyes, and below: this animal is remarkable for the great development of its infra-orbital cavities].

The Addax, or Nubian Antelope (*A. addax*, Licht.).—Also three curves to the horns, which are larger and more slender than those of the preceding: it is whitish, tinged with grey on the back, and has a large brown spot on the forehead. [There are horns in both sexes, as in most of the foregoing: this animal seems to be allied rather to *A. strepticerus*, pertaining to a subsequent section.]

c. Horns annulated, with a double curve, but winding in an opposite direction to those of the preceding, the points directed backward; the *Dama* of H. Smith, in part.

The Bubalus of the ancients (*A. bubalus*, Lin.).—More heavily formed than the others; the head [very] long [and the eyes situate remarkably backward]; size of a Stag, and yellowish-brown, except the end of the tail, which is terminated by a black tuft. A common species in Barbary. The *A. caama*, or *Haris-beeste* of the Cape colonists, [and *A. lunata*], range in this division. [These animals have much the aspect of a small Cow, and inhabit the more sterile regions of Africa in small herds, headed by an old male. They are easily domesticated.]

\* The *A. subgutturosa*, Gm., remarks the author, has not been pretended to differ from *A. Kevella*, further than in having a slight swelling under the throat.



Fig. 67.—Spring-bok.



Fig. 68.—Addax.

## MAMMALIA.



Fig. 59.—Great Bush Antelope.

species, the *Kips-springer* (*A. oreotragus*), distinguished by its stiff brittle hair, of a greenish-yellow colour, and especially by the singular structure of its hoofs, which do not expand or project forwards, their outline being perpendicular with the leg: its name signifies rock-springer. He also places here the Woolly Antelope (*A. lanata*, Desm.).]

e. Annulated horns with a simple curve, the point directed forward (*Redunca*, Smith). [The muzzle still naked.

To this group belong the *A. redunca*, *scoparia*, *quadriscopta*, *montana*, *tragulus*, *capreolus*, *eleotragus*, *isabellina*, *Lalandii*, *pedotragus*, *rufescens*, *madagascariensis*, &c.]

f. Horns annulated, straight, or a little curved, and longer than the head (*Oryx*, Smith, in part).

The *Oryx* (*A. oryx*, Pallas).—As large as a Stag, with slender horns two or three feet long, straight, pointed, round, the basal third obliquely annulated, and smaller in the females. It is found northward of the Cape, and in the interior of Africa. The length of its hoof, which is greater than in the other species, enables it to climb rocks, and it prefers mountain districts.

The *Algazel* (*A. gazella*, Linn.; [*A. bezoastica*, H. Smith].)—Inhabits North Africa, from Nubia to Senegal. It is often sculptured on the monuments of Egypt and Nubia; and M. Lichtenstein thinks that it is the true *Oryx* of the ancients. [The *A. leucoryx*, which is distinct, and *A. beisa*, require to be here added. Perhaps also the *Anoa depressirostris*, Auct.]

g. Horns annulated, with a simple curve, the points directed backward.

The Blue Antelope (*A. leucophaea*, Gm.).—A little larger than the Stag, of a bluish ash-colour; large horns in both sexes, uniformly curved, with more than twenty rings.

The Equine Antelope (*A. equina*, Geoff.).—As large as a Horse, and reddish-grey, with the head brown, a white spot before each eye; a mane on the neck, large horns, &c. [A nearly allied species, of equal size (*A. nigra*), has lately been discovered in South Africa, the males of which are almost wholly black. We may here mention also the *A. ellipsipræmna*, which is larger than a Stag, with a conspicuous white ring on the buttocks, and rather long coarse hair; which latter character is enhanced in *A. koba* and *A. steg-sing*.]



Fig. 61.—Oryx Antelope.

The *Cambing-oudan*, or Antelope of Sumatra (*A. suamensis*, Shaw).—Size of a large Goat; black, with white hair on the neck and throat; the horns small and pointed. [The affinity of this species with the preceding is not obvious: it is more nearly allied to *A. thar* and *A. ghoral*.]

A. Horns encircled with a spiral ring.

The *Impeaf* (*A. oryx*, Pall.).—Elk of the Cape colonists. As large as the largest Horse, with stout, conical, and straight horns, surrounded by a spiral ridge; greyish hair, with a small mane along the spine; a kind of dewlap under the neck; and tail terminated by a tuft. It lives in herds on the mountains, to the north of the Cape of Good Hope. [Allied to it is the *A. canna*, from the same locality, which is smaller and more slender.]

The *Coudou* (*A. strepsiceros*, Pal.).—Size of a Stag, with large horns in the male only, that are smooth with a triple curve, and a single longitudinal and slightly spiral ridge: a small beard on the chin, and a mane along the spine. This animal lives solitarily, to the north of the Cape of Good Hope.



Fig. 60.—Steen-bok (*A. tragulus*).



Near it, we conceive, should be placed the *Addax*, together with the *A. syriacus*, *Alcelus*, *arctus*, and some of two others. The *A. arctus*, or Horned Antelope, is an elegant small species, the Gnu of Buffon, of a lively fulvous colour, marked with horse-like white stripes and spots. The *A. seabra* has dark regular stripes across the crupper.]



Fig. 62.—Prong-horned Antelope.

1. Horns bifurcated, (*Antilocapra*, Ord; *Dianoceros*, Smith).

Of all the forms of hollow horns, this is the most singular: a compressed branch is given off from their base or trunk, almost like the antler of a Stag; the pointed tips curve backward. The best known species is

The *Cabril* of the Canadians (*A. furcifera*, H. Smith), which inhabits the extensive plains of the centre and west of North America in vast herds: its size is nearly that of the Roe; hair thick, waved, and reddish; the antler of its horns situate near the middle of their height. [Nearly allied is the *A. palmata*, Smith, decidedly a distinct species, which has palmated forked horns, that it employs in scooping away the snow: it is

a mountain animal, the range of which appears to be more southward than that of the other.]

2. Four horns (*Tetraceros*, Leach).

This subdivision, recently discovered in India, was not unknown to the ancients. *Ælian* speaks of it, xv. c. 14, by the name of the *Four-horned Oryx*\*: the anterior pair are before the eyes, the posterior completely behind the frontal. [As the position of the horns varies in some groups of two-horned Antelopes, it may be that the anterior pair of the four-horned species are represented in the greater number, and the posterior pair in the Bush Antelopes (*Philantomba*).]

The *Tchicarra* (*A. chicarra*, Hardw.).—Size of a Roe, and nearly uniform fulvous: no horns in the female sex. It is found in the forests of Hindostan. The *A. quadricornis*, Blainv., is only known to me by a cranium, the anterior horns of which are proportionally larger; perhaps it may only differ in age.

3. Two smooth horns.

1. The Nyghau (*A. picta*, and *trago-camelus*, Gm.).—As large as a Stag, and larger: horns short, and recurved forward, peculiar to the male sex; a beard under the middle of the neck. Inhabits India.

The Chamois (*A. rupicapra*, Lin.).—The only ruminant of western Europe that can be compared with the Antelopes, but presenting peculiar characters. Its smooth horns are curved abruptly backward like a hook: behind each ear, is a sac beneath the skin, which opens externally by a small orifice.† Its size is that of a large Goat. Hair deep brown, with a black band descending from the eye towards the middle. This species traverses rocks and precipices with extreme agility, inhabiting in small troops the middle region of the highest mountains. [The *A. thar*, *sumatrensis*, *ghorral*, and other goat-like species, seem to be allied to this group and to that of *A. strepsiceros*.]

Col. Smith separates from the Antelopes, under the generic title of

#### THE GNUS (*Catoblepas*).—

The *Antilope gnu*, Gm.; a very extraordinary species, which, at first sight, seems to be a monstrous being, compounded of parts of different animals. It has the body and crupper of a small Horse, covered with brown hair; the tail furnished with long white hairs, like that of a Horse; and on the neck a beautiful flowing mane, white at base, and black at the tip of the hairs. Its horns, approximated and enlarged at the base, like those of the Cape Buffalo, descend outwardly, and turn up at the point; the muzzle is large, flat, and surrounded by a circle of projecting hairs: under the throat and dewlap is another black mane; and the legs are as slender and light as those of a Stag. Both sexes have horns.

This animal inhabits the mountains northward of the Cape; where it does not appear common, although the ancients seem to have had some knowledge of it. [There are two other very distinct species, the Brindled Gnu (*C. gorgon*), and the Taurine Gnu (*C. taurina*), both also from the interior of South Africa.]

The three remaining genera have the bony core of the horns occupied, to a considerable extent, with cells, that communicate with the frontal sinuses. The direction of their horns characterizes the several divisions.

#### THE GOATS (*Capra*, Lin.).—

Have the horns directed upwards and backwards: their chin is generally furnished with a long beard, and the chanfrin almost always concave.

\* The fossil cranium and some other bones of a gigantic four-horned ruminant, have lately been discovered in the productive Siwalik deposits of Northern India, the *Silathorium*, Cunt, and Pale; twice the size of a large Ox.—Ed.

† It was perhaps a misconception of the nature of this aperture, which led the ancients to say, after Empedocles, that Goats breathed through their ears.



The Wild Goat, or *Agagrus* (*C. agagrus*, Gm.)—Appears to be the stock of all our domestic breeds, and is distinguished by its anteriorly sharp horns, very large in the male, short and sometimes wanting in the female;



Fig. 63.—Angora Goat.

which is also sometimes the case with the different Ibexes. It inhabits the mountains of Persia in troops, where it is known by the appellation *pasang*, and perhaps those of several other countries, even the Alps. The *oriental besoar* is a concretion found in its intestines.

Domestic Goats (*C. hircus*, Lin.), vary exceedingly in size, colour, and the length and texture of their coat; also in the magnitude, and even the number of their horns. Those of Angora and Cappadocia have the longest and most silky hair. The Thibet Goats are celebrated for the admirably fine wool which grows among their hair, of which the Cashmere stuffs are fabricated. There is a race in Upper Egypt with short hair, convex chanfrin, and projecting lower jaw, which probably is hybrid.

The Goats of Guinea, termed *mambrines* and *juida*,

are very small, with horns inclining backwards. All of them are robust, capricious, wandering animals, that betray their mountain origin by affecting dry and wild situations, where they feed on coarse herbage and the shoots of bushes. They do much injury in forests. The kid only is eaten, but their milk is useful in several diseases. The female can produce at seven months, and goes with young five months; she generally yeans two kids. The male engenders at a year old, and one suffices for more than a hundred females: in five or six years he becomes aged.

The Ibex (*C. ibex*, Lin.).—Immense horns, square in front, and marked with prominent transverse knots. It inhabits the most elevated summits of lofty mountain chains, throughout the whole ancient Continent. The Caucasian Ibex (*C. caucasicus*), has great triangular horns, obtuse but not square in front, and notched as in the preceding. Both species propagate with the Domestic Goat. The African Maned Ibex (*C. aethiopica*) is another. [These various animals with enormous horns are said to precipitate themselves fearlessly down precipices, always falling on the horns, the elasticity of which secures them from injury. Those who have observed the force with which domestic Rams butt at each other, mutually striking the forehead, will feel less surprise at the Ibexes withstanding the shock of a fall.]

#### THE SHEEP (*Ovis*, Lin.).—

Have horns directed backward, and then inclining spirally more or less forward; their chanfrin is generally convex, and they have no beard. They so little merit to be generically separated from the Goats, that the two produce by intermixture a fertile offspring. As in the Goats, there are several wild races or species, closely allied together.

The Argali, or Wild Sheep of Siberia (*Ov. ammon*, Lin.).—the male of which has very large horns, triangular at base, the angles rounded, flattened in front, and transversely striated; those of the female are falcion-shaped and compressed. Its hair, in summer, is short and greyish-fulvous; in winter close, stiff, and reddish-grey, with some white or whitish upon the muzzle, throat, and under-parts. There is always, as in the Stag, a yellowish space around the tail, which latter is very short. This animal inhabits the mountains of all Asia, and attains the stature of a Fallow Deer. [A smaller and distinct species inhabits the Himalaya mountains, which is termed the *Burrhal*: there are specimens in the Museums of the Linnean and Zoological Societies, London.]

The Corsican Moufflon (*Ov. musimon*, Pal.)—appears to differ only in its inferior size, and in the deficiency or smallness of the horns in the female sex. It is said to be also found in Crete. There are some varieties wholly or partially black, and others more or less white.

It is probable that the American Moufflon (*Ov. montana*) is a species of Argali, which may have crossed the sea on the ice. Its horns are very stout, and more perfectly spiral than those of the Asiatic Argali.

The African Moufflon (*Ov. tragelephus*, Cuv.) has soft reddish hair, with a long mane hanging under the neck, and another at each ankle; the tail short: it appears to be a distinct species, and inhabits the rocky regions of Barbary; M. Geoffroy observed it in Egypt.

From the Moufflon or Argali, it is believed that the innumerable breeds of our woolly domestic Sheep have been derived; animals which, the Dog alone excepted, have split into a greater number of varieties than any other. [One remarkable fact, however, at variance with this supposition, and which we have never yet found to be noticed, is, that all the wild races have exceedingly short tails, whereas the domestic breeds have generally, if not always when un mutilated, tails that reach nearly to the ground. It is easier to conceive the loss of this appendage in certain domestic breeds, than its acquirement or extension, and the latter theory is borne out by no analogy].

We have some in Europe with fine or common wool; large and small; with big or little horns, wanting in the female, or in both sexes, &c. The most interesting varieties are the Spanish or *Merino*, which has a fine curly fleece, with large spiral horns in the male, now beginning to be diffused through Europe, and the English, which has long and fine wool. The most common variety in southern Russia has a very long tail. Those of India and

of Guinea, which have also long tails, are distinguished by their long legs, very convex forehead, pendent ears, want of horns, and short coarse hair instead of wool. The Sheep of Northern Europe and Asia are mostly of small size, with a very short tail, [the truth being, that this appendage is merely cut short by the shepherds soon after birth]. Those of Persia, Tartary, and China, have the tail completely transformed into a double globe of fat. The Syrian and Barbary Sheep retain long tails, which are loaded with a vast mass of fat. In both the latter varieties, the ears are pendent, the horns large in the Rams and middle-sized in the Ewes and Wethers, and the wool is intermixed with hair.

Sheep are valuable for their flesh, suet, milk, skin, wool, and manure; the flocks, well managed, proving everywhere a source of fertility. The Lamb is weaned at two months, and sheds its milk teeth from the first to the third year. The Ewe propagates at one year, and is prolific for ten or twelve; its period of gestation is five months, and it often yeans two Lambs. The Ram, adult at eighteen months, suffices for thirty Ewes, and is enfeebled at eight years old.

#### THE OXEN (*Bos*, Linn.)—

Have horns directed laterally, inclining upwards or forwards in a crescent form; they are large animals, with a broad muzzle, heavy and massive body, and stout limbs.

The Common Ox (*B. taurus*, Lin.).—Specifically distinguished by its flat forehead, longer than broad, and round horns, placed at the two extremities of a projecting ridge which separates the forehead from the occiput. In fossil skulls, which appear to have belonged to this species in its original condition (the *Urus* of the ancients), these horns curve forwards and downwards; but in the numberless domestic varieties they vary exceedingly in size and direction, and are sometimes altogether wanting. The ordinary races of the torrid zone have all a lump of fat upon the shoulders, and there are some of these races not larger than a Hog. Every one is acquainted with the utility of these animals for labour, and with the value of their flesh, fat, milk, hide, and even horns. The Cow goes with young nine months, and produces at eighteen. The Bull couples at eighteen months or two years, and is useless at ten.



Fig. 64.—European Bison.

The European Bison, or *Aurochs*, (*Bos urus*, Gm.).—This species, which has been erroneously deemed the original stock of our domestic cattle, is distinguished by its convex forehead, broader than high, by the attachment of its horns below the occipital ridge, by the length of its legs, by an additional pair of ribs, by a sort of curly wool which covers the neck of the male, forming a short beard under the throat, and by its grunting voice. It is a savage animal, which at present finds refuge in the great marshy forests of Lithuania, of the Krapacs, and of Caucasus, but which was formerly spread all over temperate Europe. It is the largest of the European quadrupeds. [There is some reason for suspecting that the Caucasian or Mountain Bisons are not identical with those of Lithuania.]

The American Bison, termed *Buffalo* by the Anglo-Americans, (*B. bison*, Lin.).—The bony head very like that of the preceding; and similarly covered, together with the neck and shoulders, with frizzled wool, which becomes very long in winter; but its limbs and tail are shorter, [and it has yet another pair of ribs]. It inhabits all the temperate parts of North America, and reproduces with the domestic Cow.

The Indian Buffalo (*B. bubalus*, Lin.).—Originally from India, and brought into Egypt, Greece and Italy, during the middle ages. It has a convex forehead, longer than broad; the horns are directed backward, and marked in front by a longitudinal projection. This animal is difficult to tame, but very powerful, and prefers marshy places and coarse plants on which the Ox could not live. Its milk is good, and the hide very strong, but its flesh is not esteemed. There is a race of them in India, the horns of which include a space of ten feet from tip to tip; it is named *Arni* in Hindostan, and is the *Bos arni* of Shaw. [There would appear to be several different wild races, and many tame ones, varying much in size.]

The *Gyall*, or Jungle Ox (*B. frontalis*, Lambert).—resembles the Domestic Ox in most of its characters, but has horns flattened from before backwards, and no angular ridges. They are directed laterally and more or less upward, but not backward. It is a domestic race in the mountain districts of the north-east of India, and is perhaps derived from the intermixture of the Buffalo with the common species. [We suspect it rather to be allied to the original stock, if it be not really the latter, of the various humped breeds of India.]

The *Yak*, or Grunting Ox, (*B. grunniens*, Fal.).—A small species, with the tail completely covered with long hairs like that of a Horse, and a long mane on the back: its head appears to resemble that of a Buffalo, but the

horns have not been sufficiently described. This animal, mentioned by *Ælian*, was originally from the mountains of Thibet. Its tail constitutes the standard, still used by the Turks to distinguish their superior officers.

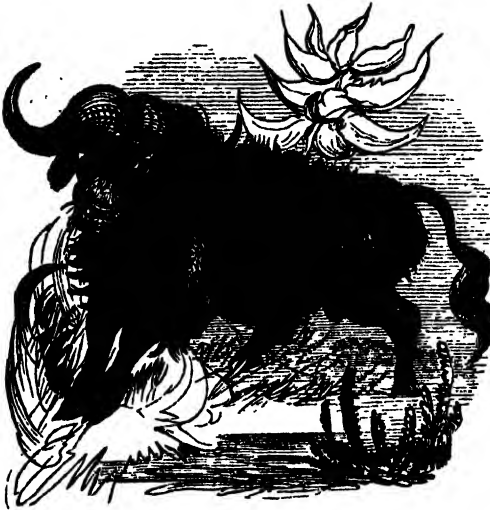


Fig. 65.—Cape Buffalo.

The Cape Buffalo (*Bos caffer*, *Sparm.*).—Very large horns, directed outward and downward and then turned upward, flattened, and so large at base that they nearly cover the forehead, leaving only a triangular space, the point of which is above. It is a very large and extremely ferocious animal, which inhabits the woods of Caffraria. [There are other African Buffaloes of inferior size, a female of one of which (*B. brachyceros*, *Gray*), or the Short-horned Buffalo, with very large ears and well-proportioned limbs, is now living in London.] Lastly,

The Musk Ox (*Bos moschatus*, *Gm.* [*Ovibos moschatus*, *Blainv.*]).—Horns approximated and directed as in the Cape Buffalo, but meeting on the forehead by a straight line: those of the female smaller and separated. The forehead convex, and extremity of the muzzle hairy. It stands low, and is covered with long hair, that reaches the ground. Tail extremely short. It diffuses more strongly the musky odour common to the whole genus, [and which is also particularly noticeable in the European Bison]. Inhabits the coldest regions of North America, where alone it has been seen, though its skull and bones are sometimes carried by the ice to Siberia.

## THE NINTH ORDER OF MAMMALIANS,—

### CETACEA,—

Consists of animals without hind-limbs: the trunk being continued by a thick tail, which terminates in a horizontal cartilaginous fin, while the head is connected to the body by so short and thick a neck, that no diminution of its circumference is perceptible: this neck consists of very slender cervical vertebræ, that are partly ankylosed or soldered together. The first bones of their anterior extremities are shortened, and the succeeding ones flattened and enveloped in a tendinous membrane, which reduces them to the condition of true fins. Hence the external form is absolutely that of fishes, except that the latter have the tail-fin vertical. They always therefore remain in the water; but as they breathe by lungs, they are compelled to return frequently to the surface to take in fresh supplies of air.\* Their warm blood; ears that open externally, though by very small orifices; their viviparous generation, mammæ by which they suckle their young, and all the details of their anatomy, sufficiently distinguish them from fishes.



Fig. 66.—Swimming Paw of Whale.

\* The larger species, however, will remain more than an hour beneath the surface: in reference to which faculty, these animals have capacious reservoirs for arterial blood along the dorsal region, and even within the head: hence, to oxygenate the great volume of

blood required to store these cavities, they continue breathing for a certain regular period, at each time of coming to the surface for that purpose.—*Ed.*

The brain is large, and its hemispheres well developed; that portion of the cranium which contains the internal ear is separated from the rest of the head, to which it only adheres by ligaments. There are never any external ears, nor hairs upon the body.

The form of the tail compels them to flex it from above downwards, to produce a progressive motion; and it greatly assists them in rising in the water.

To the genera hitherto included, we add others formerly confounded with the *Morses*, [and which have since, with still greater propriety, been placed subordinately to the great series of *PACHYDERMATA*]. They form our first family, or that of the

#### CETACEA HERBIVORA,—

The teeth of which have flat crowns, which determines their mode of life; and the latter induces them to leave the water frequently, to seek for pasture on shore. They have two teats on the breast, and hairy moustaches; two circumstances which, when observed from a distance as they raise the anterior portion of the body above water, may give them some resemblance to human beings, and have probably occasioned those fabulous accounts of Tritons and Sirens which some mariners pretend to have seen. Although, in the cranium, the bony nostrils open towards the summit, the orifices of the skin are pierced at the end of the muzzle. Their stomach is divided into four sacs, of which two are lateral, and they have a large cæcum.

##### THE MANATI (*Manatus*, Cuv.)—

Have an oblong body, terminated by a lengthened oval fin: their grinders, eight in number throughout, have square crowns, marked by two transverse ridges; there are no incisors or canines in the adult, but, when very young, there are two very small pointed teeth in the intermaxillary bones, which soon disappear. Vestiges of nails are visible on the edges of their swimming-paws, which they employ with some address in carrying their young; hence the comparison of these organs with hands, and the name of *Manatus* applied to the animals. From their manner of living, they are also called *Sea-cows*, &c.; and from their mammæ, *Mermaids*, &c.

The Manati (*Trichechus manatus*, Lin.).—Is chiefly found near the mouths of rivers, in the hottest parts of the Atlantic Ocean; and it does not appear that those of the American rivers differ specifically from those of Africa. They grow to the length of fifteen feet, and their flesh is eaten. [M. F. Cuvier, from examination of the crania, arrived at the conclusion that the African species (*M. senegalensis*, Adanson) was satisfactorily distinct; and a third, from the rivers of Florida, has since been distinguished by Dr. Harlan as *M. latirostris*.]

##### THE DUGONGS (*Halicore*, Illig.)—

Have grinders composed of two cones laterally united: the teeth implanted in the incisive bones continue to increase in length, till they become true pointed tusks, but are in great part covered by thick fleshy lips, that are bristled with moustaches. The body is elongated, and the tail terminated by a crecent-shaped flapper.

We know but of one species (*H. dugong*), which inhabits the Indian Ocean, and has been confounded by several travellers with the Manati. Like that animal, it has been named *Siren*, *Sea-cow*, &c. [There is reason to suspect the existence of several species of this genus; that of the Red Sea is described by M. Ruppell by the appellation *H. tabernaculus*.]

##### THE STELLERINES (*Rytina*, Illig.)—

Appear to have only a single composite grinder on each side, with a flat crown, and elevated ridges of enamel. Their swimming-paws have not even the little nails observable in the Manati. According to Steller, the first, and hitherto the only one who has described them, their stomach also is much more simple.

But one species is known, which inhabits the southern parts of the Pacific Ocean. [It is entirely covered with a thick rugged cuirass, formed of agglutinated hairs, like the hoofs of ungulated quadrupeds.]

The second family, or the animals which constitute the

#### CETACEA ORDINARIA,—

Are distinguished from the preceding by the singular apparatus from which they have received the appellation of *Blowers*. As with their prey they necessarily engulf, in their

capacious mouths, a great volume of water, there required to be some method of getting rid of it; and accordingly it passes through the nostrils by means of a peculiar disposition of the *velum palati*, and is accumulated in a sac situated at the external orifice of the cavity of the nose, whence, by the compression of powerful muscles, it is violently expelled through a narrow aperture pierced on the summit of the head. It is thus that these animals produce those jets of water observed by mariners at so great a distance. Their nostrils, continually bathed in salt water, could not be lined with a membrane sufficiently delicate to enable them to perceive odours; hence they have none of those projecting laminae observed in other animals: the olfactory nerve is in some wanting, and if there be any endowed with the sense of smell, it must be in a very slight degree. Their larynx, of a pyramidal form, penetrates into the posterior portion of the nostrils, to receive air and conduct it to the lungs, without the animal being obliged to raise its head and throat above water for that purpose: there are no projecting laminae in the glottis, and the voice is reduced to simple bellowing. They have no vestige of hair\*, but the whole body is covered with a smooth skin, under which [or more strictly, forming part of it,] is that thick layer of blubber abounding in oil, the principal object for which they are pursued.

The mammae are placed near the anus, and their swimming-paws are incapable of grasping.

Their stomach has five and sometimes as many as seven distinct sacs; instead of one single spleen, they have several, that are small and globular. Those species which have teeth have them all conical and similar to one another; for they do not chew their food, but swallow it rapidly.

Two little bones suspended in the flesh, near the anus, are the sole remaining vestiges of posterior limbs.

Several have a vertical fin on the back, composed of a tendinous substance, but unsupported by bone. Their eyes, flattened in front, have a thick and solid *schlerotica*; and the teguments of the tongue are soft and smooth.

They may be subdivided into two small tribes: those in which the head bears the usual proportion to the body, and those in which it is immoderately large; the first comprehending the Dolphins and the Narwhals.

#### THE DOLPHINS (*Delphinus*, Lin.)—

Have teeth in both jaws, all simple, and nearly always conical. They are the most carnivorous, and, in proportion to their size, the most cruel of their order. There is no cæcum.

#### THE DOLPHINS, properly so called, (*Delphinus*, Cuv.)—

Have a convex forehead, and the muzzle, which forms a kind of beak in front of the head, more slender than the rest.

The Common Dolphin (*D. delphis*, Lin.).—The beak-like snout depressed, and armed on each side of both jaws with from forty-two to forty-seven slender, curved, and pointed teeth: it is black above, white below, and eight or ten feet in length. This animal, found in vast herds in every sea [?], and celebrated for the velocity of its movements, which sometimes precipitate it on the decks of vessels, appears really to have been the Dolphin of the ancients. The entire organisation of its brain would seem to indicate the docility which they attributed to it.†

The Great Dolphin (*D. tursio*, Bonaterre).—The beak short, broad, and depressed; twenty-one to twenty-four teeth on each side above and below, which are conical, and often worn down: some individuals are more than fifteen feet in length. It appears that they are found in the Mediterranean as well as in the Ocean [and, though seldom taken, on account of the extreme rapidity of their movements, they are not rare in the British seas. There are numerous others].

M. de Blainville separates from these first Dolphins, under the term

#### DELPHINORHYNCHUS,—

Those species in which the snout, though elongated and slender, is not separated from the forehead by a distinct groove.

\* Except in the genus *Inia*, d'Orbigny, wherein there are true moustaches.—Ed.

† This animal must not be confounded with a fish (*Coryphæus*

*Hippurite*), celebrated for its beautiful iridescent colours, which bears the same popular name.—Ed.

One has been thrown upon our coasts (*D. micropterus*, Cuv.), remarkable for the small size and backward position of its dorsal fin; it attains a length of fifteen feet, and loses all its teeth at an early age. [Only a single specimen of this remarkable species has ever been obtained, which was cast upon the shore near Havre: its form is slender and elongated, and the head is externally attached to the body by a distinct neck. No teeth were discovered in either jaw in the recent state; but after the gums were removed, a few rudimentary teeth were found in the lower jaw, as often happens in the upper jaw of the Cachalots. This animal constitutes the *Aodon*, we believe, of Lesson.]

Another, which also sometimes occurs in our seas (*D. rostratus*, Cuv.), has a slender muzzle, externally all even with the head, and twenty-one teeth on each side of both jaws. Its dorsal is of the ordinary size.

The Soosoo of the Ganges (*D. gangeticus*, Roxburgh) should be separated from the foregoing, having the spiracle in a longitudinal line, and slender jaws swollen at the end. [Its teeth are thirty on each side above and below, and according to M. F. Cuvier, the long symphysis and the intermaxillary crests approximate it to the Cachalots.] It ascends very high up the Ganges, and is probably the *Platanista* of Pliny, [which might be adopted as its generic designation].

#### THE PORPOISES (*Phocæna*, Cuv.)—

Have no beak [the largeness of the front-head compensating for its non-extension], but a short muzzle, uniformly convex.

The Common Porpoise (*Delph. phocæna*, Lin.), compressed and trenchant teeth, of a rounded form, to the number of twenty-two or twenty-four on each side of both jaws; blackish above, the under-parts white. It is [one of] the smallest of the *Cetacea*, not exceeding four or five feet in length, and is very common in all our seas, where it associates in vast herds.

The Grampus (*D. orca* and *D. gladiator*, Auct.).—Large conical teeth, a little crooked, eleven on each side above and below, the posterior transversely flattened: body black above and white beneath; a whitish crescent-shaped mark over the eye; and the dorsal fin elevated and pointed. It is the largest of the Dolphin group, becoming from twenty to twenty-five feet in length; and is a cruel enemy to the Whale, which it attacks in troops, tormenting it till it opens its mouth, when they devour the tongue.

A smaller species is occasionally met with on our coasts (*D. aries*, Risso; [*Ph. griseus*, F. Cuv.]), which loses its upper teeth at an early age, and retains but few of the lower: its dorsal fin is less elevated and placed further backward than in the Grampus, which latter is the true *Aries* of the ancients. The *Epaulard ventrus* of Bonaterre presents a similar form; but Hunter's specimen was eighteen feet in length, whereas the present species does not exceed ten.

[The species with globular heads compose the

#### GLOBICEPHALUS, Lesson.]

The Deductor, or *Ca'ing Whale* (*Delph. globiceps*, Cuv. [*Gl. deductor*, Scoresby]).—Head globular, with long and pointed swimming paws: attains a length of more than twenty feet; and is black, with a white streak from the throat to the anus. This species lives in troops of several hundreds, conducted by old males; and is sometimes thrown upon our coasts. It has from nine to thirteen teeth on each side above and below, but loses all of them with age. [A beautiful second species (*Gl. Rissoi*) exists in the Mediterranean, and two others have been delineated and described.]

#### THE DELPHINAPTERUS, Lacepede,—

Merely differs from the Porpoises in having no dorsal fin. [This name has more recently been confined to such as have a beak like the Dolphins, the others constituting the

#### BELUGA, Lesson.

To the latter subdivision appertain]

The White Beluga (*Delph. leucos*, Gm.; *D. albicans*, Fabr.), with nine teeth on each side above and below, thick and blunt throughout; a yellowish-white skin; head externally convex like that of a Porpoise, [but more approaching to globular], and size that of a Grampus. It inhabits all the glacial seas, and sometimes ascends rivers to some distance. [Is occasionally met with on the British coasts.

To the restricted

#### DELPHINAPTERUS—

belongs]

The White-beaked Dolphin of Peron (*D. leucorhamphus*, Per.; [*Delphinapterus Peronii*, Less.], an inhabitant of the Austral seas, the head of which is but slightly convex and rather pointed, and the muzzle, part of the swimming-paws, and all the under parts of the body, lustrous-white; the superior portion black. It has from thirty-eight to forty-two teeth on each side above and below.\*

\* M. Rafinesque speaks of a Dolphin with two dorsal fins [on which he bestows the appellation *Oxypterus*]; and M. M. Quoy and Gaimard saw one they have named *D. rhinoceros*, *Fog. de Freycinet*, II. f. 21; but as they only saw it at a distance, and half-immersed in the waves, there may have been some optical delusion.

THE BOTTLE-HEADS (*Hyperoodon*, Lacep.)—

Have the body and muzzle nearly similar externally to those of the Dolphins properly so called, but the cranium is laterally elevated by vertical bony partitions: most usually there are found only two small teeth in the fore-part of the lower jaw, which do not always appear externally; the palate is studded with small tubercles, [and there is a small dorsal fin].

But one species is known, which attains a length of five-and-twenty feet, and perhaps more, [*Delph. edentulus*, Schreb.; *D. bulskopf*, Lacepede; *D. bidentatus*, Hunter; *D. Hunteri*, Desm.; the *Bottle-nosed Whale* of Hunter].—It is taken in the British Channel and the North Sea, and is often designated *Baleine à bec*.

[THE DIODONS (*Diodon*, Lesson)—

Principally differ from the preceding in having a flattened forehead: their lower jaw is much larger than the upper, and convex.

There is a species in the Mediterranean (*Delph. Desmarestii*, Risso), fifteen feet in length; a specimen of which, or of another closely allied, was cast on shore on the coast of Scotland (*D. Sowerbii*, Desm. and Blainv.) Several others are said to belong to this subdivision.]

THE NARWHAL (*Monodon*, Lin.)—

Has no teeth, properly so called; but very long and slender-pointed tusks implanted in the inter-maxillary bones, and directed in the line of the axis of the body. The form of their body and head greatly resembles that of the Porpoises, [and still more the Beluga, as noticed by Prof. Bell; the swimming paws being also remarkably small, and the dorsal fin wanting, as in the latter animal].

Only one species is known (*Mon. monoceros*, Lin.; [*Narwhalus microcephalus*, Bonat., Lacep., Desm.]), the tusk of which, grooved spirally, and sometimes ten feet long, was formerly termed the horn of the *Unicorn*. This animal possesses the germs of two tusks, but it is seldom that both become equally developed. That on the left side usually attains its full growth, while the other remains permanently concealed within its socket, its development having been prevented by its interior cavity becoming too rapidly filled with the deposition of ivory, which thus obliterates its gelatinous core. According to the description of the Narwhal, it is scarcely more than twice or three times the length of its tusk; the skin is marbled with brown and whitish; it has a convex muzzle, small mouth, spiracle placed on the top of the head, and no dorsal fin, but merely a projecting crest the whole length of its spine. The teeth are sometimes found perfectly smooth.

[We may here mention, at the conclusion of the *Cetacea* with moderate-sized heads, an extremely remarkable genus,—

## THE INIA, d'Orbigny,—

Which has the external form of the Dolphins, properly so called, with some coarse bristly hairs on the snout: the spiracle is placed far backward, above the swimming-paws; the lips are deeply cleft to beneath the eye; and there is a small dorsal fin, and proportionally large auditory aperture.

The only species known (*I. Boliviana*, d'Orb.) is remarkable for occurring thousands of miles from the sea, appearing to inhabit only the remote tributaries of the Amazons, and the elevated lakes of Peru: the singular character of possessing bristly hairs on the snout has also been observed in them when very young. This species has large swimming-paws, and thirty-four teeth on each side above and below, all of them rough, marked with deep and interrupted furrows, and of an irregular mammalory shape behind, which is very peculiar. A female specimen measured seven feet long, and the males are stated to be double that size: colour variable, commonly pale blue above, passing into a roseate hue beneath. It comes more frequently to the surface than the marine species, and is generally met with in troops of three or four individuals.]

The remaining *Cetacea* have the head so very large, as to constitute one-third or even half the entire length; but neither the cranium nor the brain participates in this disproportion, which is wholly due to an enormous development of the bones of the face.

THE CACHALOTS (*Physeter*, Lin.)—

Are *Cetacea* with a most voluminous head, excessively enlarged, particularly in front; in the upper jaw of which there are neither teeth nor baleen (*whalebone*), or, if any of the former, they are small, and not projecting beyond the gum; but the lower jaw, straight, elongated, and corresponding to a groove in the upper one, is armed on its two sides with a row of cylindrical or conical teeth, which enter into corresponding cavities of the upper jaw when the mouth is closed. The superior portion of their enormous head consists almost entirely of large cavities, separated and covered by cartilages, and filled with an oil that becomes concrete on cooling, well known in commerce by the name *spermaceti*, a



substance for which they are principally hunted, as the body does not yield a large proportion of blubber: these cavities, however, are very distinct from the true cranium, which is rather small, is placed under their posterior portion, and contains the brain as usual. It appears that cavities filled with this spermaceti, or *adipocire* as it is called, are distributed to several parts of the body, communicating with those which fill the mass of the head; they even ramify through the external fat or blubber. The odorous substance known by the appellation *ambergris* appears to be a concretion formed in the intestines of the Cachalots, particularly during certain states of disease, and, it is said, chiefly in the cæcum.

The species of this genus are by no means well determined. That which appears most common, the *Ph. macrocephalus* of Shaw and Bonaterre, but not of Linnæus, has a mere callous prominence instead of a dorsal fin; there are from twenty to twenty-three teeth on each side of the lower jaw, and small conical ones hidden beneath the gum in the upper: its blow-hole is single, and not double as in the greater number of *Cetacea*; neither is it symmetrical, but is directed towards the left, and terminates on that side on the front of the muzzle, which latter is truncate.\* In addition to this, it is stated that the left eye is often smaller than the other, for which reason the whalers endeavour to attack it on that side. This species must be very extensively distributed, if, as is asserted, it alone furnishes the whole of the spermaceti and ambergris of commerce, for these substances are brought from both the north and south. Cachalots without a dorsal fin have even been taken in the Adriatic.

#### THE PHYSETERS, Lacepede, —

Are Cachalots with a dorsal fin.

Two species only have been distinguished (*micrope*, and *tursio* or *mular*), and those merely by the equivocal character of having the teeth curved or straight, blunt or pointed. These animals are found both in the Mediterranean and glacial seas, in the latter of which they are reputed to be cruel enemies to the Seals.

#### THE WHALES (*Balena*, Lin.) —

Equal the Cachalots in size, and in the proportional dimensions of the head, although the latter is not so much enlarged in front; but they have no teeth whatever [beyond the rudiments of them in the foetal state]. The two sides of their upper jaw, which is keel-shaped, are furnished with thin, transverse, serrated laminae, termed *baleen* or *whalebone*, composed of a sort of fibrous horn fringed at the edges, which serve to retain [and strain from the water] the minute animals on which these enormous cetaceans feed. Their inferior jaw, supported by two osseous branches arched outwardly and upward, without any armature, affords lodgment to a very thick and fleshy tongue, and, when the mouth is closed, envelopes all the internal part of the upper jaw and the baleen with which it is invested. These organs do not allow Whales to feed on such large animals as their vast size would lead to imagine. They subsist on fish, but principally on worms, mollusks, and zoophytes, and it is said that they chiefly take the very smallest, which become entangled in the filaments of the baleen. Their nostrils, better organized for smell than those of the Dolphins, have some ethmoidal laminae, and appear to receive some small olfactory nervous filaments. They have a short cæcum.

The Great Northern Whale (*B. mysticetus*, Lin.) was long considered to be the largest of known animals, but it appears from the recent observations of Capt. Scoresby, that it scarcely ever exceeds seventy feet in length, which the Rorquals or Whales with wrinkled bellies frequently surpass. It has no dorsal fin. To procure its blubber, often several feet in thickness, and yielding an immense quantity of oil, whole fleets are annually equipped in pursuit of it. Formerly bold enough to venture into our seas, it has gradually retired to the far north, where the number is daily diminishing. Besides its oil, it furnishes the black and flexible *whalebone* of commerce, the pieces of which are eight or ten feet long, and to the number of eight or nine hundred on each side of the palate. A hundred and twenty tons of oil are obtained from a single individual. Shelled Mollusks attach themselves to its skin, and multiply there as upon a rock; the *Balanus* family even penetrate into it. The excrement is of a fine red colour, and affords a tolerable dye. There is a very similar species in the Antarctic seas.

Other species,

#### THE RORQUALS (*Balenoptera*, Lacepede), —

Have a dorsal fin, and are subdivided according as the belly is smooth or wrinkled. [As the former section is unquestionably founded in error, as suspected by Cuvier†, we pass to those] which have the throat and under-parts wrinkled with deep longitudinal folds, and consequently susceptible of great dilatation, the intent of which, in their economy, is yet unknown.

\* We have verified on two crania this want of symmetry in the spiracle, announced by Dudley, Anderson, and Swedlauer, which induces us to credit the inequality of the eyes mentioned by Egde.  
† The wrinkled belly being simply filled out with water.



There are two in the European seas, viz.,—the Great Rorqual (*Bal. boops*, Lin.),—superior in length to the common Whale, and shunned on account of its extreme ferocity, and the small quantity of its oil; and the Small Rorqual (*Bal. musculus*, Lin.), which differs from the other [in its very inferior size, in its proportions, and number of vertebrae. There is a third in the southern seas, and also a distinct fossil species.

On proceeding to determine the fixed analogies of the teeth throughout the different groups of *Mammalia*, we have arrived (since most of the foregoing pages were *stereotyped*) at the conclusion, that no *placental* mammalian has more than three pairs of incisors, or three pairs of true or persistent molars, (normally,) in either jaw; all seeming exceptions being reducible to this general proposition: whereas the *Marsupials* have normally four of each, and some even five. By *persistent* molars, are intended those which are not preceded by *milk-teeth*.

Following, then, the indications afforded by the structure of the molars, (which we conceive to furnish the most available guide to sound classification,) we are next led to recognize two principal varieties of dentition among the *Placentalia*, to one or the other of which every observed modification may be definitively referred. These two varieties are characteristic of a great *zoophagous* type and a great *phytophagous* type.

Where exceptions occur in the former instance, the amylaceous parts of vegetables, as fruits, seeds, and farinaceous bulbs or roots, are almost exclusively resorted to; and animal products are preferred to the composition of the recent carcass in those few exceptive cases which, in a trivial degree, affect the latter generalization.

The *zoophagous* type of dentition is obviously of a higher grade than the other, and the animals in which it occurs require more nutritious aliment.

Throughout the *zoophagous* division, the molars are compact in texture, and the enamel never dips into their substance; the basal growth of the teeth (except the pseudo-incisive canines only, in the very singular genus *Cheiromya*), ceases upon the latter attaining their required size; in consequence of which they gradually wear down by attrition, till in aged animals they are not unfrequently reduced to stumps.

In the *phytophagous* division, the molars are much less compact, and the enamel generally dips into their substance in various ways; the teeth are commonly furnished with persistent formative pulps, which deposit fresh substance at their base as their crowns wear away, so that they continue permanently growing. The exceptions that occur to this general definition do not intrinsically affect the distinctness of the present group from the other, and are easily understood, so that a transverse section of a molar (known to be that of a placental animal) will suffice in every instance for the determination to which it belongs.

These two great divisions somewhat analogously subdivide each into two sections, which differ considerably in the general details of their organization, and most commonly in the structure of the teeth. They may be regarded as *normal* and *abnormal* sections.

In the normal sections of the *zoophagous* and *phytophagous* grand divisions of *Placentalia*, the four sorts of teeth—incisors, canines, renewed and persistent molars—are generally present, or at least three sorts of them, each characterized by a particular form and structure different from the rest. In the abnormal sections, the teeth are commonly much more numerous, and alike in structure, and consist principally or even wholly of false molars; all of them are without exception single-rooted.

We might consider these four sections as *Orders*, and denominate them as follow.

#### A. *Zoophagous type*.

1. *Typodontia*. Normal: comprehending the *Bimana*, *Quadrumana*, and *Carnassiers* of Cuvier.
2. *Isodontia*. Abnormal: consisting of the *Cetacea* of Cuvier, divested of the herbivorous subdivision.

#### B. *Phytophagous type*.

3. *Diplodontia*. Normal: comprising the *Pachydermata*, *Cetacea herbivora*, *Rodentia*, and *Ruminantia* of the same naturalist.

4. *Apilodontia*. Abnormal: corresponding to the *Edentata* of Cuvier, divested of the *Monotremata*.

These together constitute the *normal* or placental subclass of *Mammalia*; and the *abnormal* or ovo-viviparous subclass might range in two orders only, viz.:

5. *Heterodontia*. Normal: or the *Marsupialia*: and
6. *Pseudodontia*. Abnormal: or the *Monotremata*.

The *Typodontia* primarily subdivide into the *Primates* and *Feræ* of Linnæus, or *Secundates*, as the latter has recently been termed by De Blainville.

The *Primates* are characterized by the external distinctions popularly known, and also, it may be added, by their hair being of one sort only, having never any softer felt beneath it.\* They separate into *Cheiropoda* and *Cheiroptera*.

The *Cheiropoda* comprise the *Bimana* and *Quadrumana* of Cuvier, but not the marsupial handed animals, included under this name by Mr. Ogilby. They have never more than four incisors in either jaw, invariably possess a cæcum, have no *os penis*, and are born with the eyes open. They subdivide into *Anthropida* and *Lemuria*.

The *Anthropida* are characterized by the general form of the head, the complete separation of the orbits from the temporal fossa by a bony partition, by having the incisors broad and contiguous, and vertical, or nearly so, in both jaws, by their anthropoid molars, &c. Their teeth form an even series, the continuity of which is only broken by the interspace required for the reception of the opposite canine; and in *Man* only, where the canines are not lengthened beyond the other teeth, even this vacuity does not occur. They fall into the *Catarrhini* and *Platyrrhini* of Geoffroy, according to the number of *false* molars; and the circumstance of their being respectively peculiar to the Old and New Worlds, affords a presumptive argument that the human genus, which pertains strictly to the former, is not indigenous to America.

\* We were deceived by certain appearances in stating that exceptions to this rule existed, at pp. 87, 89.

The *Lemuria* are mostly distinguished by a vulpine muzzle, with separated incisors in the upper jaw, those of the lower directed horizontally forward, as are also the inferior canines, which the author reckoned as a third pair of incisors. Their cheek-teeth are often sharply tuberculated; and the doubling down of the ears in some, the character of the fur, the particular structure of the female reproductive organs, nocturnal habits, and a variety of other characters, forcibly recall to mind the insectivorous Bats. Among them, the genus *Chetrogaleus* is remarkable for the total absence of superior canines; and that of *Chetromys* for having rodent canines, which pass through the intermaxillary bones, and supply the place of incisors, which are altogether wanting.

The *Chetoptera* have never more than four incisors to the upper jaw, but commonly six below, which is the normal complement. Amongst their less obvious distinctive characters from the other *Primates*, may be mentioned the constant absence of any cæcum, and the presence of a small *os penis* within the *glans*, but different from that of ordinary occurrence among the *Secundates*. They are born with their eyes closed. Following the fancy of Linnæus in applying the name *Lemur* to the preceding group, we propose to designate the two principal divisions of *Chetoptera*,—*Harpypia* and *Spectra*, which, in various respects, are analogous to the *Anthropida* and *Lemuria*.

The *Harpypia* have blunt molars, an extremely elongated stomach, and long intestines; also a sonorous voice, and most usually a claw to the fore-finger. Though stated to feed, in some instances, partly on insects, we have reason to believe (from recent observation of a living animal, which invariably rejects all insect-food that is offered to it,) that they are exclusively frugivorous. All are peculiar to the eastern hemisphere.

The *Spectra* have a globular stomach, short intestines, and sharp tubercles to the molars, except in the very extraordinary genus *Desmodus*, which, for reasons connected with its habits, has no true molars whatever. They have a clicking voice, and no claw to the fore-finger, &c.

The second sub-order of *Typodontia*, or the *Fera*, or *Secundates*, subdivides into the obvious groups *Carnivora* and *Insectivora* of Cuvier; but as these names are equally applicable to Marsupial genera, and therefore particularly liable to mislead, by inducing the erroneous supposition that they apply to all carnivorous and insectivorous *Mammalia* respectively, in which significant general sense they might still be employed with convenience, just as the analogous terms *Herbivora* and *Frugivora* are at present, we believe that they might advantageously be disused in their restricted and forced meaning, to be superseded by names of more special application. We therefore venture to designate them *Cynodia* and *Ecanina*. It is in this division that the four different sorts of teeth assume their most distinctive characters, as it is unnecessary to dwell upon. The incisors are rarely less than six in number, in either jaw.

In the *Cynodia*, the canines are always present, both above and below, and are invariably strongly characterized as such; and the incisors form a transverse range, the outer pair, more particularly those above, being always largest, and the medial smallest. They fall into four subtribes, viz., *Digitigrada*, *Subplantigrada*, *Plantigrada*, and *Pinnigrada*; the first and last of which are constantly furnished with a cæcum, which does not occur in the others.

The *Digitigrada* are not always digitigrade, but the term need not on this account be altered. We adopt the group as instituted by Cuvier, detaching only the first leading subdivision, or that of the Weasels and allied genera.

The *Subplantigrada* have never more than one true molar above, and another below, which vary exceedingly in development, in an inverse ratio to the *carassator*, or *scissor-tooth*,—the Weasels and Badgers exhibiting the extremes. The great and small intestines scarcely differ in calibre; and all, unless the Otters constitute an exception, can diffuse at will a disgusting stench. None of them fall into a torpid state during the winter, like the northern *Plantigrada*. Their hind feet are always semi-plantigrade, but none of them bring the heel quite to the ground.

The *Plantigrada* have constantly two pairs of true molars in each jaw, which likewise vary exceedingly in development, and in an inverse ratio to the scissor-teeth, which in the Bears are reduced to their minimum throughout the *Cynodia*. In their plantigrade gait, and generally naked sole (not naked by friction merely, as in the Badgers), their tendency to torpor during severe weather, and a variety of other particulars, a direct affinity to the *Insectivora*, Cuv., is very apparent; and the Raccoons among them are further remarkable for the entire separation, and a certain amount of prehensibility of the toes, which last enables them to clasp small objects in a manner observed in no other *Secundates*,—the rest of the *Cynodia* having a membrane more or less developed between the toes. The skull of the Bears exhibits various tokens of affinity with the next group.

The *Pinnigrada*, or Seals, correspond to the *Amphibia* of Cuvier, and are remarkable for the similarity of their true and false molars; the former of which, however, in no instance, exceed the typical number.

The *Ecanina*, or second and abnormal subtribe of *Secundates* (being the *Insectivora*, Cuv.), have an attenuated muzzle, and mostly separated incisors that face laterally, the medial or foremost being always largest, as in the *Primates*; no true upper canines, but very commonly an enlarged false molar with two fangs, that presents the appearance and performs the office of a canine, the lower canines being always present (unless in the Shrews), but commonly very small, and hence ranked as a fourth pair of incisors. They have generally three true molars, both above and below, and always perfect clavicles, which is the case in no species of *Cynodia*. The genera *Macroscelides* and *Tupaia* alone possess a cæcum; and the Shrews, which have no incisors, nor even intermaxillary bones that should contain the upper ones, are remarkable for possessing two very curious front teeth, which we suspect are modified false molars.

We shall offer no further remarks on the *ISODONTIA*, or *Cetacea ordinaria* of Cuvier, than to observe, that the Narwhal alone among them possesses other than false molars.

The *DIPLODONTIA*, or normal order of the great phytophagous type, divides first into *Brochata* and *Ungulata*, the names of which require to be admitted with some reservation, though certainly not with more than—nor indeed so much as—the *Edentata* of Cuvier. They have always a voluminous cæcum, with the single, and consequently very remarkable, exception of the small Dormouse group.

The *Brochata* have ordinarily (at least the three first principal divisions of them) permanently growing canines, which either pass through the intermaxillaries, as in the Elephants and Rodents—*carrying their nutriment*, how-

ever, from within the true maxillaries—or they are directed outwards, as in the Pigs and Hippopotami. The composite structure of the molars, from which this order takes its name, attains its most remarkable development in the present division, as observed in the Elephant, the Capybara, and the Phascoglossa. They have rarely fewer than four, and often five distinct toes on each foot; and generally a cleft upper lip, less observable when the nose is prolonged into a snout, or proboscis. They separate into *Proboscidea*, *Rodentia*, *Chiroptera*, and *Syrenia*.

The close affinity of the *Proboscidea* and *Rodentia* was distinctly pointed out and descanted upon by Cuvier in his *Osséments Fossiles*, to which valuable work the reader is necessarily referred, from want of space to enlarge upon the subject here. The tusks of the *Proboscidea* are mostly peculiar to the upper jaw, where they attain enormous dimensions, being small when present in the lower one. Their form is cylindrical, with conically-pointed tips, and they are surrounded with enamel.\*

The *Rodentia* have approximated tusks in both jaws, with enamel only in front; and the Hares alone among them possess true incisors in the upper jaw only, in front of which the tusks pass, protruding in their usual site throughout the group. They have neither an elongated snout nor a proboscis; and their extremities are unguliculated. In the Hare, which has six rootless molars, the three first alone are preceded by rooted milk teeth; and the anterior molar, in numerous other genera, the adults of which have four, is in like manner preceded by a deciduous rooted tooth, which is shed about the time the last posterior molar protrudes through the gum.

The *Chiroptera* have always incisors, their tusks, of similar kind to those of the two preceding groups, being directed outwards, and those of the upper and lower jaws generally rubbing against each other. The Swine and Hippopotami are characteristic examples; and we are disposed to refer to this division (as a distinct minor group), the very singular genus *Hyrax*, the adults of which do not possess canines.

Lastly, the *Syrenia*, or *Cetacea herbivora*, Cuv., which have no posterior extremities, like the *Isodontia*, are likewise deprived of canines, at least the existing genera; for the *Deinotherium* (assuming that this lost genus is correctly placed here) had enormous tusks in the lower jaw only, anomalously turned downward. Their general anatomy leaves no doubt of the propriety of separating them altogether from the *Isodontia*, or zoophagous *Cetacea*, and allies them (we consider) most nearly to the *Chiroptera*.

The *Ungulata*, or grazing animals, divide, according to the simple or complex stomach, into *Bellua* & *Ruminantia*.

The *Bellua* consist of the Horses, Tapirs, Rhinoceroses, and proximate fossil genera; all of which now existing have a prehensile upper lip more or less developed, the nostrils being prolonged with it into a short flexible proboscis in the Tapirs, and there is reason to conclude in many of the extinct forms. The true and false molars present no sensible difference in the adult animal; but the dentition of the young proves that the normal complement of true molars is not exceeded.

The *Ruminantia* fall into *Ancerata* and *Pecora*; the former consisting of the Camels and Llamas, which have a cleft and prehensile upper lip, and claw-like hoofs upon which they do not rest; and the latter of the remainder, which have the upper lip entire and non-prehensile, (the tongue becoming so in its stead,) and the ends of their toes encased in hoofs, upon the soles of which the weight of the body is supported. The former alone possess any superior incisors, though only one pair; but all have six incisors in the lower jaw, together with inferior canines, which in the *Pecora* assume the form and direction of incisors, but the true analogy of which appears on comparison of them with the lower canines of either the *Bellua* or *Ancerata*, and of the Bactrian or Two-humped Camel in particular, which has no interspace (as in the others) between its lower canines and incisors.

The *AFLODONTIA*, or abnormal division of the phytophagous type, corresponding to the *Edentata* of Cuvier, is now in course of becoming unexpectedly elucidated by the extraordinarily rapid discovery of fossil genera in South America, which present a more complicated form of molar tooth than was previously known in this division, as exemplified by the newly established genera *Mylodon*, *Glyptodon*, and we venture to suggest — *Toxodon*, wherein the indentations of the enamelled sides of the teeth resemble those of many rodents. However numerous may be the false molars in certain genera of this division, the number of their true molars appears in no instance to exceed three, (at least in those which we have been able to examine, comprehending all with the unfortunate exception of *Prionodon*); and the structural distinction between their true and false molars is sufficiently evident.

Of the two Ovo-viviparous orders, there is only space left to remark, that whereas the Placental *Carnivora* and *Herbivora* are (as we have seen) modified upon two distinct types, which do not pass into each other, the Marsupial *Carnivora* and *Herbivora* pertain to the same equivalent type, and grade into each other so that an analogous line of rigid demarcation cannot be traced. This perhaps may be added to the various indications of their abnormality as a group, as compared with the preceding or Placental subclass of *Mammalia*.

In conclusion, it may here be noticed, that without intending any thing of the kind while gradually ascending to the foregoing classification, it has so happened that species with superior intelligence in conformity with their cerebral development are placed at the head of each principal group, which may or may not be fortuitous coincidence. Thus, Man ranks at the head of the most highly organized order—*Typodontia*, the Dolphin at the head of the *Isodontia*, and the Elephant at that of the great phytophagous division, and, consequently, of the *Diploodontia*; while the Dog ranges first among the *Secundata*, and the Horse first of the *Ungulata*. The leading genus of the *Aplodontia* may yet remain to be discovered. The animals here mentioned (at least the terrene kinds, for of the Dolphin we do not possess the requisite data for forming an opinion), certainly appear to possess more eminently culturable intellects than any others, such as may be applied to purposes having no relation to their natural habits; and Man has accordingly been enabled to gain them as assistants in his various labours and occupations.]

\* It may be that the *Proboscidea* supply an exception to the otherwise universal rule of placental *Mammalia* having never more than three pairs of true molars in either jaw; but we suspect that such seeming exception would upon analysis prove to be more apparent than

real, the last of them being probably analogous to the teeth which human beings sometimes develop when in vigorous senility; theoretically, a renewal of their predecessors.

## THE OVIPAROUS VERTEBRATES IN GENERAL.

Although the three classes of Oviparous Vertebrates differ very much from each other in their quantum of respiration, and in all that relates to it, viz., the power of movement and the energy of the senses, they present several characters in common when opposed to the *Mammalia*, or Viviparous Vertebrates, [certain of which are participated in by the Ovoviviparous Mammalia, or the subclass of *Marsupia* and *Monotremata*].

The hemispheres of the brain are much reduced, and [as in the Ovoviviparous Mammalia] are not united by a *corpus callosum*; the *crura* of the *cerebellum* do not form that protuberance called the *pons Varolii*; the *nates* (at least in two of these classes) attain a great development, are hollowed so as to enclose a ventricle, and [as in the Ovoviviparous Mammalia] are not covered by the hemispheres, but are visible below or on the sides of the cerebrum, [which last statement does not apply to the Ovoviviparous Mammalia]: their nostrils are less complex; the ear [as in the *Monotremata*] has not so many small bones, which in several are totally wanting; the cochlea, where it exists, which is only the case in Birds, is much more simple, &c. Their lower jaw, always composed of many pieces, is attached by a concave facet to a salient process, which belongs to the temporal bone, but is separated from its petrous portion: the bones of the cranium are more subdivided, though they occupy the same relative places, and fulfil similar functions; thus, the frontal is composed of five or six pieces, &c. The orbits are merely separated by an osseous lamina of the sphenoidal bone, or by a membrane. When these animals possess anterior extremities, in addition to the clavicle, which is often united to its fellow on the opposite side, and is then termed *fourchette*, the scapular also rests upon the sternum, by means of a very large and prolonged coracoid apophysis. The *larynx* is more simple, and has no *epiglottis*; the lungs are not separated from the abdomen by a perfect diaphragm, [except in the single instance of that extraordinary bird, the *Apteryx*], &c. But in order that these various relations should be adequately appreciated, it would be necessary to enter into anatomical details, which do not belong to this first part of our work. It is sufficient to have here pointed out the mutual analogy of the *Ovipara*, which, in reference to the plan on which they are constructed, is greater than that of any of them with the Mammalia.

Oviparous generation consists, essentially, in this; that the young animal is not attached by a *placenta* to the parietes of the uterus, or of the oviduct, but remains separate from it by its most external envelope, [all which applies to the Ovoviviparous Mammalia]. Its aliment is prepared beforehand, and enclosed in a sac attached to its intestinal canal; being what is termed the vitellus, or yolk of egg, of which the young animal is a sort of appendage, at first imperceptible, which is nourished and augmented by absorbing the fluid of the yolk. Such of the *Ovipara* as breathe by lungs, have the egg furnished with a highly vascular membrane, which appears to serve for respiration; it is connected with the bladder, and represents the allantoid of Mammalia. This membrane is neither found in Fishes, nor the Batrachians; which latter, when young, respire in the manner of Fishes, by gills or *branchiæ*.

Many of the cold-blooded *Ovipara* do not bring forth their young until they are developed and extricated from their shell, or other membranes which separated them from their parent. These are called *false Ovipara*.

## THE SECOND CLASS OF VERTEBRATED ANIMALS.

### THE BIRDS (*AVES*),—

Are oviparous vertebrates with double circulation and respiration, [mostly] organized for flight.

Their lungs, undivided and attached to the ribs, are enveloped by a membrane pierced with large holes, and which allows the air to pass into many cavities of the chest, the abdominal region, arm-pits, and even of the interior of the bones\*; so that the ambient fluid not only bathes the surface of the pulmonary vessels, but also that of an infinitude of vessels traversing the rest of the body. Thus Birds respire, in certain respects, by the ramifications of their aorta, as well as by those of their pulmonary artery, and the energy of their irritability is in proportion to their amount of respiration.† Their total conformation is arranged to participate in this energy.

Their anterior extremities, destined to sustain them in flight, could neither serve them for standing, nor for clutching: they are bipeds, then, and pick up objects from the earth with their mouth; their body, consequently, is balanced upon the legs; the thighs are directed forward, and the toes are lengthened to form a sufficient base for standing. The pelvis is longitudinally much extended, to furnish attachment to the muscles which support the trunk upon the thighs: there is even a suite of muscles proceeding from the pelvis to the toes; and passing over the knee and heel, so that the simple weight of the bird flexes the toes: it is thus that they are enabled to sleep perched on one foot. The *ischia*, and especially the *ossa pubis*, are lengthened out behind, and widened in their span, to allow the necessary space for the development of the eggs.

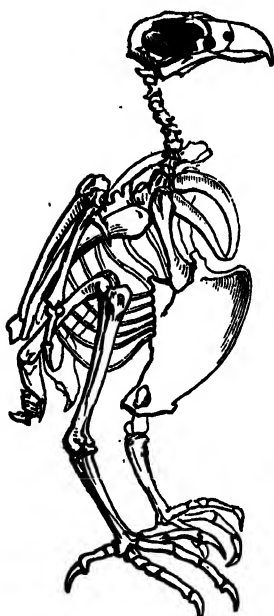


Fig. 67.—Skeleton of Jer Falcon.

The neck and the beak are elongated to reach the ground; but the former has also the requisite flexibility for doubling backward when at rest. It has therefore numerous vertebrae, [varying from twelve to twenty-three, which latter number is attained only in the genus *Cygnus*]. The trunk, on the contrary, which serves as a fulcrum to the wings, has but little mobility; the sternum especially, to which are attached the muscles which effect the propulsive stroke in flying, is of great extent, its surface [except in the Ostrich and allied genera, which do not fly,] being further augmented by a projecting ridge along its middle. It is [mostly]

\* In the Hornbills, even the phalanges of the toes are hollow, and communicate with the lungs. The opposite extreme occurs in the *Apteryx*, which has no accessory air-cavities.—Ed.

† Two Sparrows consume as much air as a Guinea-pig.—LAVOISIER, *Mémoires de Chimie*, t. 130.

composed originally of five pieces : one medial (fig. 68, *a*), of which this salient lamina [known as the sternal crest, ridge, or keel] constitutes a part ; two triangular anterior lateral [termed costal processes] (*b*), for the attachment of the ribs ; and two forked posterior lateral (*c*), for the extension of its surface ; and the greater or less degree of the ossification [that is to say, obliteration] of the notches of these last, and the extent of the interval which is left between them and their principal bone, denote the relative amount of vigour of flight in Birds. The [Eagles, Harriers, (the Falcons much more slowly, if indeed at all), and some other] diurnal Birds of prey, the Swifts and the Humming-birds, [the Parrots, and also the Storm-petrels,] lose, as they grow old, all traces of these unossified spaces. [In the



Fig. 68.—Sternal apparatus of a newly-hatched Chick.

Ostrich and its allies, the sternum is composed originally of only two pieces ; and the number likewise varies in those Birds which possess a sternal crest.]

The fourchette [*furcula*, or “merry-thought” bone], (fig. 68, *d*), produced by the junction of the two clavicles, and the two stout abutments formed by the [huge] coracoid apophyses (*e*), keep the shoulders apart, notwithstanding the opposing force exerted by the action of flying ; the fourchette, in particular, is commonly more stout and open, according as the flight of a Bird is vigorous.\* (See fig. 67.) The wing, supported by the humerus (fig. 69 *a*), fore-arm (*b*), and hand, which is elongated, and exhibits one digit and the rudiments of two [or (including the winglet *c*), three] others (1, 2, 4) is furnished throughout its length with a range of elastic quills, which greatly extend the surface that resists the air. The quills adhering to the hand are named *primaries*, and these are [almost] always ten in number† ; those attached to the fore-arm are called *secondaries*, but their number varies ; weaker feathers attached to the humerus are styled *scapularies* [*tertiaries* ; the true *scapularies* constituting that separate range which grows over the *scapulars*, or “shoulder-blades”] ; and the bone which represents the thumb‡ (*o*), is also furnished with what are designated bastard quills, [this member being generally termed *alula spuria*, or *winglet*]. Along the base of the quills is a range [and successive ranges] of feathers named *coverts* [both on the outer and inner surfaces of the wing, which receive corresponding appellations to those of the quill-feathers they impend, as *primary coverts*, &c., and are further distinguished as *greater, lesser, and least*].

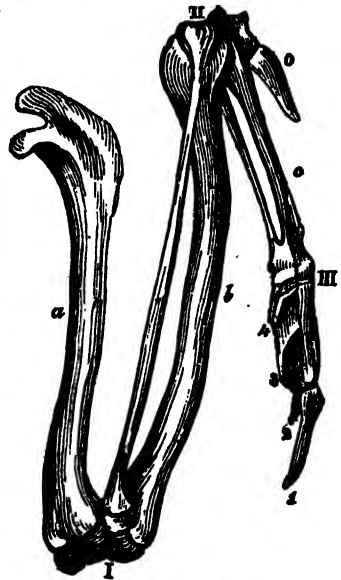


Fig. 69.—Jaw Falcon's Wing.

\* In the instance of the Parrots, some of which are birds of very strong flight, although the coracoids are always very stout (much resembling those of the Hawks), the furcula is never strong, and is peculiarly flattened, so that its resisting force is thus considerably diminished. Some Parroquets, indeed, as those small ones popularly termed Love-birds (*Agapornis*), have no furcula whatever ; and it is worthy of being noticed that the restricted Toucans (*Rhamphastos*) have the clavicles separate and very short, forming small dagger-shaped appendages, the use of which is not obvious.—Ed.

† In the Grebe genus, eleven : many of the singing birds have the

first extremely minute ; and, in the Starling and some others, it is, analogically speaking, wanting ; so that the number is in these reduced to nine.—Ed.

‡ As on the removal of digits, that of the thumb is found to be invariably the first, the rudimentary finger above referred to is now considered as analogous to the index finger of the human hand : the thumb, however, being sometimes represented by a bony spine ; as the spur of a common fowl represents the first digit of the foot.—Ed.

The bony tail is very short, [and consists in most instances of nine vertebræ, the three last of which are commonly anchylosed into a plough-share form, and are generally collectively styled the *coccyx*], but has a range of strong feathers, which, when spread out, assist in supporting the bird: their number is ordinarily twelve; sometimes fourteen, and in many of the *Gallinaceæ* eighteen; [in some few genera, as the Grebes, Nandou, &c., these are wanting altogether; a single Humming-bird (*Trochilus enicurus*) possesses only six; the Ani eight; the rest of the Humming-birds, and various others, ten; while the Swans present from eighteen to twenty-two. The two central of these feathers are implanted above the even line formed by the insertion of the rest, and essentially correspond to the wing-tertiaries, as the others do to the wing-secondaries; the latter being in no instance moulted more than once in the year, the former in many instances twice: we might accordingly designate the two central tail feathers, which differ conspicuously from the rest in structure, *uropygials*. Above and below the tail are lengthened feathers, commonly of weak texture, known as the *upper* and *under tail-coverts*.

The rest of the feathers of Birds are named from their position, as *frontal*, *coronal*, *occipital*, *nuchal*, *dorsal* or *interscapular*, which together form a continuous series, apart from the *scapularies*; those in front of the eye are termed *loral*, and the auditory aperture is covered by a range styled *auriculars* or *ear-coverts*: the sides of the neck and medial portion of the sternal and abdominal region are at most covered with down; the former being concealed by the lateral feathers of the fore and hind neck meeting; the latter by a similar junction of two distinct lateral ranges. As it is necessary that the warm body of a bird should be in actual contact with the eggs during incubation, whatever down may cover the medial inferior region disappears in the females towards the season of propagation, even in those confined in cages, so that this bareness is not produced mechanically. Finally, besides various accessory tufts in different genera, some long slender feathers are situate at the base of the wing internally, which are named *axillaries*].

The legs have a femur, a tibia, and a peronæum attached to the femur with a spring, which maintains their extension without effort on the part of the muscles. The tarsus and metatarsus are represented by a single bone, terminating below in three pullies.

Most commonly there are three toes before, and a thumb behind\*; the latter being sometimes deficient. In the Swifts it is directed forwards, [though half-reversible: in the Moth-hunters and some others, inward, at a right angle with the axis of the body]. In the yoke-footed Birds, on the contrary, the external toe and the thumb are disposed backwards [most usually, but sometimes (as in the Touracos and Puff-birds) laterally: in the Trogons, the first and second toes are opposed to the third and fourth; and accordingly the longest toe, or that which corresponds to the middle one in the generality of the class, is *inward*, instead of being *outward*, as in all the other yoke-footed groups]. The number of articulations increases in each toe, commencing with the thumb, which has two, and ending with the external toe, which has five. [The Swifts present a remarkable exception; and it may be remarked that, in the Ostrich alone, only two toes are present.]

In general, [invariably], Birds are covered with feathers, a sort of tegument best

\* The word *thumb* is here and subsequently used merely in a popular sense, to signify its antagonism to the other digits: as the hinder | thumbs of the *Quadrupeds* are represented, in the class of Birds, only by the tarsal spurs of many *Gallinaceæ*.—Eo.



adapted to protect them from the rapid variations of temperature to which their movements expose them. The air-cavities which occupy the interior of their body, and [usually] even supersede the marrow in their bones, increase their specific lightness. The sternal portion of the ribs is ossified, as well as the vertebral, to impart more force to the dilatation of the chest. To each rib is attached a small bone, which soon becomes soldered to it, and is directed obliquely backward towards the next rib, all concurring to give additional solidity to the thorax.

The eye of Birds is so conformed as to enable them to distinguish objects both far and near with equal clearness; a vascular and plaited membrane, which extends from the profundity of the globe to the edge of the crystalline, probably assists in displacing that lens. The anterior surface of the globe is also strengthened by a circle of bony pieces; and, besides the two ordinary eyelids, there is always a third, situate at the inner angle, and which, by means of a remarkable muscular apparatus, can be drawn over the front of the eye like a curtain. The cornea is very convex, but the crystalline is flat, and the vitreous humour small.

The ear of Birds has but a single small bone, formed of a branch adherent to the tympanum, and of another terminating in a plate that rests upon the *fenestra ovalis*: their cochlea is a cone slightly curved; but their semicircular canals are large, and lodged in a portion of the skull, where they are surrounded on all sides by air-cavities that communicate with the arca. [Some] nocturnal Birds alone have a large external conch, which however does not project like that of quadrupeds, [though in the restricted genus *Strix* an overlapping cartilaginous flap is developed anteriorly, by which the auditory aperture is closed at will]. The orifice of the ear is generally covered with feathers [the *ear-coverts*], the barbs of which are more fringed than those of other feathers.

The organ of smell, concealed within the base of the beak, has ordinarily three cartilaginous *ossa turbinata*, which vary in complication; it is very sensible, although it has no cavity excavated within the parietes of the cranium. The size of the bony openings of the nostrils determines the strength of the beak; and the cartilages, membranes, feathers, and other teguments which contract these apertures, exert an influence on the perceptibility of odours, and on the sort of nourishment.

The tongue has little muscular substance, and is supported by a bone articulated on the hyoid; in most Birds this organ is not very delicate. [The Parrots probably enjoy most perfectly the sense of taste.]

The feathers, as well as the quills, which differ only in size, are composed of a stem, hollow at its base, and of barbs, which are themselves furnished with smaller ones; their tissue, lustre, strength, and general form, vary infinitely. [They may be conveniently divided into clothing feathers, and those which are subservient to locomotion; the vibrissæ even, which are disposed in some instances as eyelashes, and more frequently impend the nostrils or arm the rictus of Birds, are merely barbless feathers, which are developed and periodically renewed like other feathers. In many groups, the clothing feathers are furnished with a supplementary shaft, or accessory plume, which, in the quills or sustaining feathers, is at most represented by only a few downy filaments. This supplementary plume, in the *Emeus*, is developed equally with the primary shaft, so that two similar feathers grow from the same quill: and in the Cassowary, there is even a third shaft in addition. In the Poultry and some others,



the accessory plume is large, but of soft and downy texture: others have it reduced to a small tuft of down; while in many it is absent altogether. In some Birds, the vanes of the feathers are to a variable extent united, or soldered into an uniform mass, and there are various additional modifications, too numerous to admit of detail]. The touch must be feeble in all parts that are covered with them; and, as the beak is almost always corneous and but little sensitive, and the toes are invested with scales above and a callous skin underneath, this sense can be of little efficacy in the class of Birds. [In the Snipes and *Lamellirostrres*, however, the sense of touch in the bill must be delicate, as testified by their manner of feeding, as well as by the many nervous papillæ distributed over its surface. The enormous bill of the Toucans, also, is very sensitive; and even the hardest bills are traversed by ramifications of the fifth pair of nerves, which terminate in scattered papillæ.]

The feathers are cast twice in the year [in some instances, but by far the greater number of Birds renew their plumage in autumn only; and in no instance are the wing-primaries shed excepting in autumn, or at that moult which corresponds to the autumnal moult. Many, as the Hawks, larger Gulls, &c., retain their entire nestling garb till the second autumn; while others, as the Crows, Starlings, &c., renew every feather previous to the first winter; and there are some groups, as that of the Thrushes, together with various *double-moulting* Birds, as the Pipits and Wagtails, which change their first clothing plumage soon after quitting the nest, but retain their nestling primaries until the second autumn—(that is, until the third renovation of the body feathers). In the Cormorants, Grebes, &c., some additional ornamental plumes are developed towards the commencement of the breeding season; at which time various other Birds undergo a change of colour, unaccompanied by any moult\*; while others, again, cast the terminal portion (commonly of a dingy hue) of the greater number of their feathers, which during winter had concealed the brighter tints of summer: two or more of these various modes, by which a seasonal alteration of appearance is effected, being frequently simultaneously observable in the same individual.] In certain species, the winter plumage differs in its colours from that of summer; and in the greater number, the female differs from the male by colours less vivid, and the young of both sexes then resemble the female. When the adult male and female are of the same colour, the young have a peculiar livery. [As thus expressed, however, these rules require to be qualified by numerous exceptions: the true enunciation of them being, that, when the plumage of the young differs from that of the adult male, or of the female in those few cases where (as in the common Gallinule) this sex is the brighter, that of the other sex may be similar to either of those extremes, or is in various degrees intermediate: the male and female of the common British Redstart, for instance, are dissimilar, and the young do not resemble the adult female; but the garb of the latter is intermediate to those of the adult male and young.†]

\* When this takes place, as in certain Gambets (*Totanus*), the colouring matter is often entirely absorbed previously to the autumnal change of feather; and in some double-moulting species, as the Golden Plover, it commonly happens in spring that the colouring secretion tinges the old feathers that are loose, and ready to drop off,—thus proving that a circulation obtains in the pores of feathers, even up to the period of their being naturally cast.—Es.

† There is a typical state of plumage in most groups of Birds, which, in certain species, as the Tree Sparrow, is common to old and young of both sexes; but which is very usually obtained only by the adult male, as is observable in the common House Sparrow: in the Robin, Goldfinch, &c., to select other familiar examples, it is acquired by the

adults of both sexes; and, in the Common Gallinule, only by the mature female. There are also many Birds in which neither sex assumes this comparatively advanced livery: the larger Bitterns, for example, both sexes of which permanently retain the markings and style of colouring characteristic of only the first or immature dress of the Dwarf-bittern (subgenus *Ardeola*); the adult male common Bunting (*Emberiza hortulæ*), also, thus exhibits corresponding livery to that proper to the females and young of the rest of its group, never advancing, like the males of the other species of Bunting, beyond its primitive nestling colours and markings. We are led to recognize, therefore, two extreme conditions of plumage as regards the colouring,—one generally, but not always, characteristic of matu-

The brain, in Birds, offers the same general characters as in the rest of the *Ovipara*; but is distinguished by its very considerable proportionate size, which often even surpasses that of this organ in the Mammalia. It is principally on the tubercles analogous to the *corpora striata* that this volume is dependent, and not upon the hemispheres, which are very small and without convolutions. The *cerebellum* is tolerably large, and almost without lateral lobes, being principally formed by the vermiform process.

The *trachea* of Birds has its rings entire; at its bifurcation is a *glottis*, most usually furnished with peculiar muscles, and named the *lower larynx*; it is there that the voice

is uttered—the other of immaturity; the first having usually more decided and contrasted colours; the second being comparatively sombre, with paler or more blended colours, which however are commonly broken into various streaks or spots, and other different mottlings; where the latter condition, however, becomes permanent, the variegations of the adult bird are in general more distinctly defined; thus a beautiful Himalayan Thrush (*Turdus Philae*), which occasionally strays into Europe, retains the mottling of the dorsal plumage peculiar to the unmoulted young of other Thrushes, but the colours of those mottled feathers are much more finely brought out; in like manner the distinct transverse bars on the adult plumage of the Bush-shrikes (*Thamnodon*) and those on certain Woodpeckers (*Colaptes*), respectively represent the more indistinct markings of the nestling dress of the ordinary Shrikes (*Lanius*) and certain other Woodpeckers (*Chrysomitris*), which barred plumage is succeeded in the latter by an adult garb devoid of those markings: this increased distinctness is however less apparent in some cases, as in that of the Bittern of North America, the adult markings of which correspond, feather by feather, (their intensity being but inconsiderably enhanced,) with those of the immature Dwarf-bittern already referred to.

Accordingly, then, it is in the first plumage of Birds that the affinity of allied groups is ordinarily most apparent, as is analogously the case with the young of animals in general (the distinctions of all essentially allied groups of which condense to decrease till they disappear successively, as we ascend to the embryo); and the same remark applies, as might be anticipated, to the shape and structure of the feathers, equally with their colouring. Thus, the nestling garb is always much less firm than that subsequently attained; and those feathers which are acuminate in the adult are rounded, or but slightly narrowed, in the young, and in general become gradually more elongated and pointed at each successive moult, till they have acquired their final shape and development: the dorsal feathers of the common Heron, and clothing plumage of the Starling, may be cited in exemplification. In this respect, also, as with their colouring, the feathers of some species, compared with those of others proximately allied, are specifically arrested at various stages of development: the adult plumage of the Bittern represents in this particular the immature garb of the Herons generally; and in the weakness of texture of the dorsal feathers, equally with their mottled markings, the mature livery of the *Ianthocincla* corresponds with the nestling dress of the majority of other Birds of the Thrush tribe.

It should be remarked that in some cases where the typical plumage is finally attained, this is only after a series of moultings more or less numerous, each successive stage of which may or may not present a nearer approximation to it in different species; it being thus assumed gradually, or abruptly; and, in such cases, it is generally acquired by the male sex sooner than by the female, where both ultimately arrive at it. In the European Oriole, the male alone attains the typical garb, but not before its third or fourth change of plumage, when it is assumed abruptly, or nearly so; in the Dwarf-bittern, the male acquires its final livery at the first moult, the female not before the third or fourth moult, presenting an intermediate garb in the mean while, which is ultimately exchanged for the same livery as that of its mate. The amount of constitutional vigour tends to determine the period at which the more advanced condition of plumage is obtained, in the ratio of the average period required for its assumption; thus, we perceive little or no irregularity in those instances where the typical dress is gained at the first renewal, but considerable irregularity where the period of its assumption is ordinarily protracted; and it would seem that in the latter case the females are more apt to acquire ultimately the most advanced livery, than in those instances where the male alone regularly obtains it at the first moult; though, as there is always a tendency on the part of vigorous females to throw out the masculine attire, it may be that this apparent difference arises simply from the fact of such females being liable to escape notice, from their consequent similarity to the other sex inducing a belief that they belong to it, and so precluding further examination. Of species thus usually presenting a marked sexual diversity of plu-

mage, we have seen females of the common Redstart, Linnet, Redpole, Red-backed Shrike, and Scaup Pochard, which could not be distinguished externally from males; and all of them contained eggs in the ovarium.

As the assumption of the typical plumage, then, in species wherein it is tardily acquired, is especially dependent on the amount of constitutional vigour, it follows that captive Birds should generally arrive more slowly at their final livery, than those individuals which are unconfin'd; and it might be predicated, also, that instances of captive females assuming the male plumage, in those species wherein the females ordinarily differ from the males, would be of comparatively unfrequent occurrence. Such are accordingly the facts: but it requires to be noticed, that any effectual injury to the ovarium, or other cause of sterility, also occasions female Birds to throw out the masculine livery (just as the Doe, mentioned at p. 187, with one scirrhous ovary, developed an antler on the same side), this fact being very commonly noticed in Pheasants and domestic Poultry. On the other hand, however, it is still more remarkable that a male bird, analogously injured, will sometimes even moult back from the typical plumage to that proper to the female and young; though caponized fowls retain their male costume.

We have thus far treated on the subject only under its most simple phase, as observed in those species which renew their plumage in autumn only; and have entered somewhat into detail, from experience of the great assistance rendered by a knowledge of the characters thus afforded in tracing the affinities of groups, by simple inspection of the plumage: being enabled thus to perceive the systematic relationship of various genera at a glance, which is not obvious in the rest of their external characters, nor even in this one to persons unacquainted with the normal progressive changes characteristic of the particular group. In illustration, let it be supposed that a species of Sparrow existed (which is quite probable), the males of which, like the females of the House Sparrow, retained permanently the colouring of the nestling garb of the latter, (or, in other words, that its plumage presented the same analogy with that of the House Sparrow which the common Bunting's plumage does to that of its congeners); the affinity of such a species to the Tree Sparrow, both sexes of which exhibit at all ages a style of colouring corresponding to that peculiar to the adult male of the House Sparrow, would be rendered intelligible by the mutation incidental to the latter, even though no actual similitude were traceable between the plumage of the Tree Sparrow and that of the imagined species. There are numerous groups, then, the relationship of which may be at once recognised on the principle here indicated.

Among those species which retain their first plumage till the second autumn, its aspect undergoes considerable variation in some, from different causes. Thus, in the Oprey, Gannet, and some others, the upper parts are for a while conspicuously speckled with terminal white spots, on a dark ground-colour; which spots gradually disappearing, as the terminal edges of the feathers are naturally shed, leave the back uniformly dark-coloured and plain. In certain other groups, as in some Harriers (*Circus*), an actual change of colour takes place in the feathers, to a variable extent.

In those species of Birds which undergo a double moult, the sexes are generally smaller, or nearly so, in both states of plumage, and always in the winter dress; and even the summer and winter livres do not in all cases differ, as may be observed in the Tree Pipit (*Anthus arboreus*). Where the contrary prevails in both sexes, the young, in their first down, are subject to possess the colouring of the adult summer garb, as noticeable in the common Guillemot and Razorbill; and, in the plumage which succeeds the down, to resemble the mature winter dress, or to present a combination of the two, which is not uncommon—particularly among the small waders, which subsequently attain their proper winter clothing plumage by a moult towards the close of autumn. When the breeding livery of the male and female differs, the same law prevails as in single-moulting Birds. We have not space to enter more minutely into detail.—E.

of Birds is formed; the enormous volume of air contained in the air-cavities contributes to the strength of this voice, and the *trachea*, by its various forms and movements, to its intonations. The *upper larynx*, which is extremely simple, has little to do with it.

The face, or upper mandible of Birds, formed principally by the intermaxillaries, is prolonged backwards into two *arcades*, the internal of which is composed by the *palatine* and *pterygoid bones*, the external by the maxillaries and jugals, and which are both supported on a moveable tympanic bone, commonly termed the square bone (*os carré*), that represents the *drum* of the ear: above, this same face is articulated or united to the skull by elastic laminae; a mode of union which always leaves some mobility.

The horny substance which invests the two mandibles supplies the place of teeth, and is occasionally serrated, so as to represent them.\* Its form, as also that of the mandibles which support it, varies excessively, according to the sort of food resorted to.

The digestion of Birds is in proportion to the energy of their vitality, and the amount of respiration. The stomach is composed of three parts: the *craw*, which is an expansion of the gullet; the *proventriculus*, a membranous stomach, furnished in the thickness of its coats with a multitude of glands [variously disposed and shaped in different groups], the secretion of which humects the aliment; and lastly, the *gizzard*, armed with two powerful muscles united by two radiating tendons, and internally lined by a coating of cartilage. The food is more readily ground there, as Birds are in the habit of swallowing small stones to augment its tritulating power.

In the greater number of species which subsist only on flesh or fish, the muscles and the internal lining of the gizzard are reduced to extreme tenuity, so that it appears to make but one sac with the proventriculus. [The same is noticeable in the Bustards, which subsist mainly upon herbage: a series of intermediate gradations, however, occurring from these to the most powerfully muscular gizzards.]

The dilatation of the craw is also sometimes [even generally] wanting. [This is commonly situate above the furcula, but in the genus *Palamedea* beyond it: in the Grebes, there is a contraction and intervening space between the proventriculus and gizzard†, which in the very peculiar genus *Opisthocomus* is developed into a considerable cavity (this bird subsisting mainly on green foliage): the *Totipalmati* have generally an accessory pouch to the stomach, analogous to that of the Loricated Reptiles. It may also be mentioned here, that in the Parrots and Pigeons, both exclusively vegetable feeders, the craw is furnished with numerous glands, which become

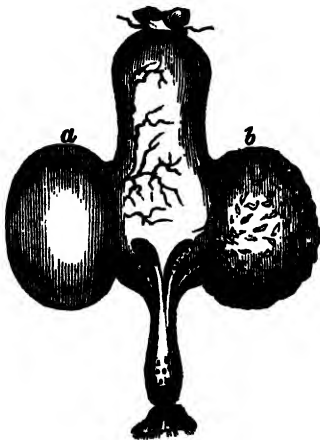


Fig. 70.—Pigeon's Craw.

\* See note to p. 30.—Ed.

† The same contraction is noticeable, to a less extent, in the Mer-  
gansers, and other piscivorous Birds with strong and muscular  
gizzards: hence the fishes that they swallow are mechanically pre-

vented from entering the gizzard till they have been sufficiently  
reduced, by the action of the gastric juices elaborated in the proven-  
tricular, to pass its aperture.

of incubation, and the function of which is to secrete a lacteal substance, with which the young are at first nourished. The craw of Birds generally is situate on the right side only; but in the Pigeons it is double, and fig. 70 represents the ordinary aspect of that on one side when inflated (*a*), and the thickened glandular appearance of that on the other (*b*), as noticeable in Pigeons that have newly-hatched young. In other Birds, the craw merely serves as a reservoir for such food as cannot be immediately taken into the stomach; though 'grain is generally moistened there and softened, by macerating in fluid sipped for the purpose].

The liver voids its bile into the intestine by two ducts, which alternate with the two or three by which the pancreatic fluid passes. The pancreas of Birds is large, but their spleen is small; they have no epiploon, the functions of which are in part fulfilled by the partitions of the air-cavities. The cæcal appendages [when present] are placed near the origin of the rectum, and at a short distance from its outlet; these are more or less long, according to the regimen of the bird.\* The Herons [as also the Smew Merganser] have only one, which is minute; in other genera, as that of the Woodpeckers, they are wanting altogether.

The *cloaca* is a pouch in which the rectum, the ureters, and the spermatic ducts—or, in the female, the oviduct—terminate; it opens externally by the anus. As a general rule, Birds do not urinate; the secretion of the kidneys being mingled with their solid excrement. The Ostriches alone have the cloaca sufficiently dilated to allow of an accumulation of the urine. [In the majority of Water-fowl, there is a small accessory pouch to the cloaca, termed the *bursa Fabricii*: its use has not been clearly ascertained.]

In most of the genera, coition is effected by the simple juxta-position of the anus; the Ostriches and many aquatic Birds [those which copulate in water], however, have a penis furrowed with a groove, along which the seminal fluid is conducted. The testicles are situate internally above the kidneys, and near the lungs; [they attain an enormous development towards the season of propagation;] only one oviduct is developed, the other [with its ovary] being reduced to minute size.

The egg, detached from the ovary, where only the yolk is perceptible, imbibes in the upper part of the oviduct that exterior fluid termed the white, and becomes invested with its shell in the lower part of the same canal. The chick is developed by incubation, unless where the heat of the climate suffices, as in the case of the Ostrich [in some localities]. The young bird has on the tip of its beak a horny point, which serves to rupture the shell, and falls off a few days after exclusion.

Every one knows the varied industry which Birds exhibit in the construction of their nests, and the tender care which they take of their eggs and young; it is the principal part of their instinct. With regard to the rest, their rapid passage through different regions of the air, and the intense and continued action of that element upon them, renders them presensible of the variations of the atmosphere, to an extent of

\* Some difficulties occur in the way of this explanation, unless duly qualified in reference to the normal characters of particular groups, or subtypes of form. Thus, the Hawks and the Owls subelst pretty nearly on the same regimen; the coeca being in the former instance constantly minute, and in the latter as invariably of considerable size, but with the same proportional dimensions in every species: nor can this diversity be explained on another principle that has been advanced, equally correct in its application to groups; viz., that the somnolent inactive Owls require to have more complex digestive-organs (which should retain the chyme longer in its passage), than

the more energetic tribe of Falcons; inasmuch as the rapidly-flying, active Harfang, or Snowy Owl, which on the wing can scarcely be distinguished from the Jer Falcon, possesses coeca—as before generally intimated—proportionally quite as large as those of the light-fapping Barn Owl; while the lazy, smooth-sailing Buzzard, the floating Kite, and the buoyantly-skimming Harrier, present no further development of these appendages than the darting Hawks, or the impetuous, far-rushing Falcons. A variety of analogous instances might be enumerated.—Ed.

which we can have no idea, and from the most ancient times has caused to be attributed to them, by superstitious persons, a power of announcing future events. It is doubtless upon this faculty that the instinct depends which [periodically] agitates migratory Birds, and impels them to direct their course towards the equator when winter approaches, and pole-ward at the return of spring.\* They are not devoid of memory, and even imagination—for they dream; and every body knows with what facility they may be tamed, taught [in numerous instances] to perform various services, and to retain airs and words.

#### DIVISION OF THE CLASS OF BIRDS INTO ORDERS.

*Of all classes of animals, that of Birds is the most strongly characterized, that in which the species bear the greatest mutual resemblance, and which is separated from all others by the widest interval.*

Their systematic arrangement is based, as in the *Mammalia*, on the organs of mastication or the beak, and on those of prehension, which are again the beak, and more particularly the feet. [The configuration of the sternal apparatus, also, (which we have illustrated by numerous figures,) and the modifications of the digestive and sometimes vocal organs, supply highly important characters on which to ground the subdivisions.]

One is first struck by the character of *webbed* feet, or those wherein the toes are connected by membranes, that distinguish all *swimming* Birds.† The backward position of their feet, the elongation of the sternum, the neck, often longer than the legs, to enable them to reach below them, the close, shining plumage, impervious to water,—altogether concur with the feet to make good navigators of the *Palmipedes*.

In other Birds, which have also most frequently some small web to their feet, at least between the two external toes, we observe elevated tarsi; legs denuded of feathers above the heel-joint; a slender shape; in fine, all the requisites for fording along shallow water, in search of nourishment. Such, in fact, is the regimen of the greater number; and, although some of them resort exclusively to dry places, they are nevertheless termed *Shore-birds* or *Waders*.

Amongst the true land-birds, the *Gallinaceæ* have—like our domestic Cock—a heavy carriage, a short flight, the beak moderate, its upper mandible vaulted, the nostrils partly covered by a soft and tumid scale, and almost always the edges of the toes indented, with short membranes between the bases of those in front. They subsist chiefly on grain.

*Birds of prey* have a crooked beak, with its point sharp and curving downward; and the nostrils pierced in a membrane that invests its base: their feet [save in the Vulture group] are armed with stout talons. They live on flesh, and [the Vultures

\* It is certain, however, that the rapid enlargement of the sexual organs is the immediate stimulant to migration in the spring; while decline of temperature, most generally, is the directly predisposing agent in the autumn: this is manifest in the case of migratory Birds kept in confinement. The instances of the Swift, and adult Cuckoo, retiring southward at the hottest season of the year, are more difficult of explanation, and indicate some ulterior agency not hitherto divined; though they do not affect the multitudinous observations, which conclusively prove the influence of decline of temperature. It is less easy to imagine physical agency that should constantly impel migratory animals to travel in the right direction; and the marvel increases when we consider the length of route ordinarily traversed, and still

more the extraordinary fact (familiar to all practical observers) of Birds of passage, unless when driven by stress of weather, returning, both in summer and winter, to their former place of abode, and this even when reared in confinement, and released immediately previous to their first journey.—ED. (See note to p. 81.)

† It is most difficult thus to generalise in the class of Birds. For instance, the Gallinules, or *Moorhens*,—habitual swimmers,—have no connecting membrane to the toes; while the Terns, which are never seen to swim, have their toes completely webbed, &c. Even the Herons, the Curlews, and numerous other *waders*, will sometimes take the water of their own accord, and swim across pools, though their structure does not indicate such a habit.—ED.

again excepted] pursue other Birds; their flight accordingly is mostly powerful. The greater number still retain a slight web betwixt their external toes.

The *Passerine Birds* comprise many more species than all the other families; but their organization presents so many analogies that they cannot be separated, although they vary very much in size and strength. Their two external toes are joined at the base, and sometimes higher.

Finally, the name of *Climbers* is applied to those Birds in which the external toe is directed backwards like the thumb, because the greater number of them [some of them] avail themselves of a conformation so favourable for a vertical position, to climb along the trunks of trees.\* [As constituted upon this single character, the present group is a most unnatural one, excluding genera that in every other respect belong to it, and including the Parrots, which differ widely from the rest in every other detail of their conformation. Besides the Parrots, also, which are the only true *climbers* among Birds, (if we except perhaps the Colies,) the Woodpecker and Barbet groups comprise all the yoke-footed species which ascend the trunks of trees, the latter only being enabled to descend them; and corresponding genera to these occur among the *Passerine Birds*, as the Creepers and their allies—to the Woodpeckers, and the Nuthatches—to the Barbets. The Trogons moreover, as stated at p. 156, are yoke-footed on a different principle from the rest. We have no hesitation in placing the Parrots at the head of the whole series of the class of Birds.]

Each of these orders subdivides into families and genera, principally after the conformation of the beak. But these different groups pass into each other by almost imperceptible gradations, insomuch that there is no other class in which the genera and subgenera are so difficult of limitation.

## THE FIRST ORDER OF BIRDS,—

### THE BIRDS OF PREY (*ACCIPITRES*, Lin.)—

Are recognized by their hooked beak and talons,—powerful weapons, with which they immolate other Birds, and even the weaker Quadrupeds and Reptiles. They are among Birds what the *Carnivora* are among Quadrupeds.† The muscles of their thighs and legs indicate the force of their claws; their tarsi are rarely elongated: they having all four toes; and the claw of the thumb and that of the innermost toe are the strongest.

They constitute two families, the Diurnal and the Nocturnal.

The *DIURNAL BIRDS OF PREY* have the eyes directed sideways; a membrane, termed the *cere* [as in the Parrots], covering the base of the beak, in which the nostrils are pierced; three toes before [the outer in the Osprey genus reversible], and one behind, unfeathered, the two exterior almost always connected at base by a short membrane; the plumage close, the quills strong, and flight powerful. [They have constantly a large *craw* (fig. 71) or dilatation of the gullet]; their stomach is almost wholly membranous; their intestines [save in the Osprey genus] but little extended, and furnished with minute *ceeca*. The sternum (fig. 72) is large and completely ossified, [or with only a posterior foramen left, in most of the genera], in order to give more extended attachment to the muscles of the wing; and their fourchette

\* In my first *Elementary Sketch*, in 1798, I was obliged to suppress the order *Pica* of Linnæus, which has no one determinate character, [at least as constituted by that naturalist]. M. Illiger, and the majority

of recent Ornithologists, have assented to this suppression.

† As the frugivorous Parrots may be compared to the *Quadrupeds*. —Ee.

(fig. 72, a) is semicircular and very wide, the better to resist the violent pressure of the humerus incidental to a rapid flight. [The young undergo no change of feather until their second autumn; and they renew their plumage slowly, and in no instance more than once in the year; its seasonal change being confined to a slight wearing off, rather than a natural shedding, of the margins of the feathers: in several species, however, the colour indicative of maturity is partially acquired, previously to moulting, by a change of hue in the first or nestling plumage. The eggs of Accipitrine Birds are nearly spherical; and those of the present division are generally more or less spotted or blotched with rusty-brown. The young are at first densely clad in short soft down.]

Linnaeus made only two genera, which are two natural divisions,—the VULTURES and the FALCONS.

#### THE VULTURES (*Vultur*, Lin.)—

Have the eyes even with the head; the tarsi reticulated, or, in other words, covered with small scales; the beak lengthened, curved only at the end; and a greater or less portion of the head, and generally of the neck, [in the adult,] devoid of feathers. The force of their talons does not correspond with their stature, and they make more use of their beak than of their claws. Their wings are so long, that in walking they hold them half-extended. They are of a cowardly disposition, and feed on carrion oftener than on living prey: when they have gorged themselves, their craw forms a large protuberance above the fourchette, a fetid humour issues from their nostrils, and they are almost reduced to a state of apathy. [They differ, moreover, from all the succeeding groups, till we arrive at the Poultry,—with the sole exception of the Secretary genus (*Gypogeryx*), which indeed might be ranged with them,—in possessing more than twelve cervical ver-

Fig. 71.—Alimentary Canal of the Common Buzzard: exhibiting the first expansion, or *cæce*; and (below the divarication of the *fræcæe*) the proventriculus, stomach, and intestines. The second figure represents the termination of the small intestines, with the rectum swelling below to form the cloaca, and two minute *cæca* placed at the junction of the great and small intestines.\*

tebræ †: their fourchette, though extremely stout and wide, is flattened as in the Owls; the sternal crest low, and reduced anteriorly; and the posterior edge of the sternum (fig. 73), in some of those of America, is doubly emarginated for some time: they even further accord with the Owls in having a rib less than the Falconine genera.

#### THE VULTURES, properly so called, (*Vultur*, Cuv.)—

Have a large and strong beak, the nostrils opening cross-wise at its base, the head and neck without feathers or caruncles, and a collar of long feathers, or of down, at the base of the neck. They have hitherto been found only on the old continent [but none of the tribe are met with in Australia, where the absence of larger indigenous quadrupeds than the Kangaroos, and of predatory animals that should leave the surplus of their meals to putrefy, indicate that they could not be supported.] ‡



Fig. 72.—Sternal apparatus of the Common Harrier. N.B. The keel (b) is rather more developed in the Falcons; less so in the Eagles.

\* Copied from McIlhenny's *Rapacious Birds of Britain*.—Es.

† In the long series of groups adverted to, the thirteenth vertebra generally, but not always, bears a pair of minute ribs, which diminish till they disappear in some species; if, therefore, the thirteenth vertebra is to be considered as cervical in such cases, as not bearing

a rib, the difference is essentially trifling, and does not intrinsically affect the above generalization.—Es.

‡ The *Alcterus*, Gray, which has been ignorantly classified with the Vultures, is, in every respect a true Poultry bird.

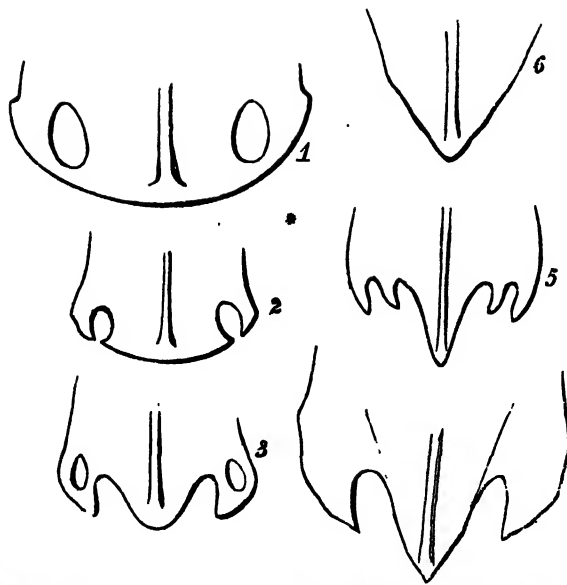


Fig. 73.—1, hind margin of the sternum of a true Vulture—2, ditto, of Neophron—3, ditto, of *Cathartes aura*—4, ditto, of *C. Californicus*, the formulae of which have become obliterated—5, ditto, of another presumed *Cathartes*—6, ditto, of Secretary.

The Oricou Vulture (*V. auricularis*, Daud.), an African species, [probably the largest of the true Vultures,] has a longitudinal fleshy crest on each side of the neck, above the ear, [a character which likewise occurs, less prominently, in one or two others].

America produces Vultures remarkable for the caruncles which surmount the membrane at the base of the beak; the latter is as large as in the preceding, but the nostrils are oval and longitudinal. They are

#### THE CONDORS (*Sarcorampus*, Dumeril).—

[A very distinct genus, remarkable for having no muscles attached to the trachea, in consequence of which they are necessarily deprived of voice, emitting no sound beyond a weak snorting. Their hind toe is shorter than in other *Accipitres*.]

The King Condor (*V. papa*, Lin.).—Size of a Goose. The naked parts of the head and neck vividly coloured, and the caruncle denticulated like the comb of a cock. It inhabits the Pampas and other hot parts of South America. This species is termed the *King of the Vultures*, from the Gallinazos giving place to it, through fear, whenever it settles upon a carcass which they had begun to devour.

The Great Condor (*V. gryphus*, Lin.); the male of which, in addition to his superior caruncle†, has another under the beak, like the cock. The female differs in colour, and is without the caruncles. This bird has been rendered famous by exaggerated reports of its size: it is little larger than the Bearded Griffin, which its manners resemble. It inhabits the most elevated regions of the Andes, and flies higher than any other bird.

#### THE GALLINAZOS (*Cathartes*, Cuv.).—

Have the beak of the Condors, that is to say, large, with longitudinal oval nostrils, but no fleshy crest: their head and neck are without feathers; [plumage nearly or wholly black: the sternum emarginated inward of the ordinary foramen. All the species are from America.]

The Great Gallinazo (*V. californianus*, Shaw).—approaches the large Condor in size, with proportionally longer wings. [From the western coast of North America.]

The Turkey Buzzard of the Anglo-Americans (*V. aura*, Lin.).—Little larger than a fowl. [There appear to be others, hitherto imperfectly determined.]

#### THE NEOPHRONS (*Neophron*, Cuv.).—

Have a long and slender beak, rather tumid above its curvature; the nostrils oval and longitudinal,

\* No species of bird has more than twelve tail-feathers (including the *uropigials*) till we arrive at the Poultry. Hence, the *Alcedo*,—mentioned in the preceding note,—which possesses eighteen, might in this character alone have been referred to its proper station.

† It is proper to remark that the rigid cartilaginous crest of the male of this Condor offers no analogy, anatomically, with the fleshy caruncle of the other.—E.S.

The Fulvous Vulture (*V. fulvus*, Gm.) is the most widely-diffused species, inhabiting the mountainous parts of the whole ancient continent. Its body surpasses in size that of a Swan [possibly in the instance of some females. This bird has been erroneously stated to have fourteen tail-feathers.\* The greater number of the genus possess similar characters.]

The Dusky Vulture (*V. cinereus*, Gm.).—As widely distributed as the preceding [but less numerously], and still larger: it frequently attacks living animals. [This species exemplifies the subgenus *Gypse* of Savigny; having the beak more sharply pointed, the nostrils almost round, and the head partially clothed with feathers. The Vultures generally, indeed, have the head and neck feathered when young, like the Turkey and other birds which have bald heads in a state of maturity: the immature *V. Angolensis*, Gm., is doubtfully figured by Bennett as a species of Caracara (*Polyborus? hypoleucos*); but the adults of that species continue to have those parts invested.]



and the head, but not the neck, devoid of feathers. They are birds of moderate size, and in strength do not approach the Vultures properly so called; hence they are even more addicted to carrion and all sorts of filth, which attract them from afar. They do not even disdain to feed on excrement.

The White Neophron (*V. percnopterus*, Lin.)—Little larger than a Raven: the adult male [and probably also the old female] white, with black quill-feathers; the female and young brown. [It is common in Africa, and the countries bordering the Mediterranean; rare in the north of Europe: has been once killed in England.] It follows the caravans in the desert, to devour all that dies.

The Urabu (*V. fota*, Ch. Bonap.), or Carrion Crow of the Anglo-Americans.—The same size and form as the preceding, but with a stouter bill, and the head entirely naked; plumage wholly deep black. It abounds in the temperate and hot parts of America, [and is generally ranged in *Cathartes*.] One or more additional true Neophrons, however, exist in Africa.]

#### THE GRIFFINS (*Gypætos*, Storr).—

Placed by Gmelin in his genus *Falco*, approximate the Vultures rather in their habits and conformation: they have the eyes even with the head; the claws proportionally feeble; wings half-extended when at rest; the claw, when full, projecting at the bottom of the neck: but their head is completely covered with feathers; [and they have only thirteen cervical vertebrae, which is one more than in any of the Falcons; the Neophrons and Gallinazos possessing fourteen, and the Condors and true Vultures fifteen. The sternum is proportionally short, and very broad.] Their distinctive characters consist in a very strong, straight beak, hooked at the point, and inflated on the curve; nostrils covered [owl-like] with stiff hairs directed forward; and a pencil of similar hairs under the beak: their tarsi are short, and feathered to the toes; and their wings long, having the third quill longest.

The Bearded Griffin, or *Lammer-geyer*, (*V. barbatus*, and *Falco barbatus*, Gm.)—This is the largest bird of prey belonging to the Eastern Continent: it inhabits the high chains of mountains, but is not very common. It nestles in inaccessible acclivities; attacks Lambs, Goats, the Chamois, and even, it is said, sleeping Man [or persons standing on the edge of a precipice]; it is pretended that children have been sometimes carried away by it, [a statement recently confirmed by facts, in more than one instance]. Its method is to force animals over steep precipices, and to devour them when disabled by the fall. It does not, however, refuse dead bodies. Its length is nearly five feet (French), and extent of wing from nine to ten feet. This bird is the *Phænx* of the Greeks, and the *Ossifraga* of the Latins. [The species of the Himmalayas is considered to be different.]

#### THE FALCONS (*Falco*, Lin.)—

Constitute the second, and by much the most numerous division of the diurnal birds of prey. They have the head and neck covered with feathers: their eye-brows [except in the Ospreys] form a projection which occasions the eye to appear sunk, and imparts a very different character to their physiognomy from that of the Vultures: the majority of them subsist on living prey; but they differ much in the amount of courage displayed in the pursuit of it. Their first plumage is often differently coloured from the adult, and they do not [in most instances] assume the latter for three or four years,—a circumstance which has occasioned the species to have been greatly multiplied by nomenclators. The female is generally one-third larger than the male, which, on this account, has been named a *tercel*.

It is necessary to subdivide this genus first into two sections.

THE FALCONS, properly so called, (*Falco*, Bechstein), commonly termed the *Noble Birds of Prey*,—

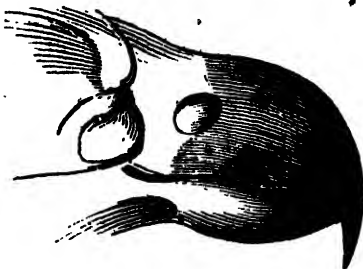


Fig. 74.—Beak of Jar Falcon.

Compose the first. They are the most courageous in proportion to their size, a quality which is derived from the power of their armature and wings. Their beak (fig. 74), curved from its base, has a sharp tooth on each side near the point; and the second quill of their wings is the longest, the first nearly equalling it, which renders the entire wing longer and more pointed. From this, also, result particular habits: the length of the quills of their wings weakens their efforts to ascend vertically, and renders their forward flight, in a calm state of the atmosphere, very oblique, necessitating them, when they wish to rise directly, to fly against the wind. They are

exceedingly docile Birds, and are those which are most generally employed in *falconry*, being taught to pursue game, and to return when called.

The Peregrine Falcon (*F. communis*, Gm.; [*F. peregrinus*, Lin.].—Apparently a cluster of indefinitely distinguishable species, generally diffused in temperate climates, both northward and southward of the equator]. The species mostly trained for purposes of falconry.

[There are numerous others, of which the Jer Falcon, the Lanner,—which is intermediate to the Jer and Peregrine Falcons,—the Hobby, the Red-legged, and the Merlin Falcons, inhabit northern Europe. The Red-legged Falcon is remarkable for sometimes breeding in society. *F. concolor* and some others have the tarsi elongated; and in *F. aesalon* (the Merlin), and some allied species, the third quill-feather equals and sometimes exceeds the second; these last are also somewhat Hawk-like in the structure of their feet, and in their manners. The division of Kestrel-falcons (termed *Cercanetes* by Boié) comprehends Birds of weaker structure, which have the sternum proportionally smaller; in some the front of the tarsi is scutellated, as in the short-winged Hawks: the Kestrel-Falcons prey chiefly on field-mice, which they discern as they hover stationary at a moderate altitude, with the head invariably turned towards the wind; it is thus that they have obtained the names of *Wind-hover* and of *Stand-gall* or “stand-gale:” there are several species, two only of which inhabit Europe—the common Kestrel (*F. tinnunculus*, Lin.), and the White-clawed Kestrel (*F. cenchris*, Frisch. and Naum; *F. tinnunculoides*, Tem.).

The division *Hierofalco*, Cuv., was instituted by mistake, for the reception of the Jer Falcon, under the supposition that its beak had only a festoon, as in the short-winged Hawks; the tooth of these Birds being sometimes cut away by the falconers. *Gampsonyx*, Vigors, however, fulfils nearly the conditions which were assigned to *Hierofalco*; the upper mandible being devoid even of emargination, and considerably resembling that of the Buzzards: the head is small, feet and tarsi robust, the latter feathered half-way from the joint; wings the same as in *Falco*: one species only is known, a bird of small size from Brazil (*G. Swainsonii*, Vig.).

Other species (the *Ierax*, Vigors), of very small size, have the second and third quill-feathers nearly equal; the upper mandible strongly and sharply bidentated, by the further development of a sinuation visible in the rest. Two species are known, from Java and Manila respectively, (*F. ceruleascens*, Edwards, and *I. erythrogenys*, Vig.).—They are scarcely larger than a Swallow, but yield to none in energy and spirit: their wings, however, are less firm than in other Falcons.

There are some bidentate species, which in other respects accord more nearly with the Goshawks: they are

#### THE HARPAGONS (*Harpagus*, Vig.; *Bidens*, Spix),—

Which present an acute bidentation of both mandibles, and have hitherto been found only in South America.

The best known species (*F. bidentatus*, Latham) is figured in the adult state by Spix as *Bidens rufiventris*, and in immature plumage as *B. albiventer*.

Others more nearly approximate the Pernas, as

#### THE FALCOPERNES (*Lepidogenys*, Gould),—

The wings of which are remarkably long, having the third quill longest; feet very short, and the talons small and but slightly curved: the bidentation is less strongly marked than in the preceding.

*F. lophotes*, Tem., an elegantly-crested bird from India, and another from Australia—*L. subcristatus*, Gould, pertain to this division. Nearly allied would seem to be the *Aviceda*, Swains., from Western Africa; except that its armature is considerably more powerful.] The *Basa* of Hodgson is probably identical with *Lepidogenys*.

The second section of the great genus *Falco* is that of the Birds of prey termed *Ignoble*, because they cannot be so well employed in falconry; a tribe much more numerous than that of the *Nobles*, and which it is necessary to subdivide considerably. Their longest quill-feather is almost always the fourth, the first being very short, which has the same effect as if the tip of the wing had been obliquely cut off; hence, *ceteris paribus*, result diminished powers of flight. Their beak, also, is not so well armed, as there is no lateral tooth near its point, but only a slight festoon about the middle of its length.

#### THE EAGLES (*Aquila*, Brisson),—

Which form the first tribe, have a very strong beak, straight at its base, and curved only towards the point. Among them we find the largest species of the genus, and the most powerful of all the Birds of prey.

#### THE EAGLES, properly so called (*Aquila*, Cuv.)—

Have the tarsi feathered down to the base of the toes: they inhabit mountains, and pursue Birds and Quadrupeds; their wings are as long as the tail, their flight both elevated and rapid, and their courage superior to that of most other Birds.

[The Golden Eagle (*F. chrysaetos*, Lin.), the Grecian Eagle (*A. Hellaca*, Savigny; *F. imperialis*, Tem.), the Spotted Eagle (*F. naevius* and *maculatus*, Gm.), the Social Eagle (*A. Bonelli*, Bonap.), and the Little Eagle (*F. pennatus*, Gm.), are the European species, which successively decrease in size in the order announced; the last-named being smaller than a Common Buzzard.]

New Holland produces Eagles of similar form to those of Europe, the tail excepted, which is cuneiform. Such is the Wedge-tailed Eagle (*A. fucosa*, Cuv.).

[There are many others.] We should remark that the transition from the Eagles to the Buzzards is effected by insensible gradations, [the typical Buzzards being merely small-sized Eagles, with weaker armature].

#### THE ERNES (*Haliaeetus*, Cuv.)

Have wings resembling those of the preceding, but the tarsi clothed only on its upper half with feathers, the remainder being semi-scutellated. [Their beak also is longer and larger.] They frequent the shores of rivers and of the sea, and subsist in great part upon fish [without disdaining carrion, like the true Eagles].

The Cinereous Erne (*F. albicilla*, Lin.) of Europe, and the American White-headed Erne (*F. leucocephalus*, Lin. fig. 75) are characteristic examples. There are also some of small size, as the bird commonly termed the Pondicherry Kite (*F. ponticerianus*, Gm.), which the Hindoos consider sacred to Vishnu. The *Cunduma* of Hodgson is merely a large *Haliaeetus*].



Fig. 75.—White-headed Erne.

#### THE OSPREYS (*Pandion*, Savigny)—

Have [somewhat] the beak and feet of the Ernes; but their talons are round underneath, while in other Birds of prey [save in the true *Elans*] they are grooved or channelled; their tarsi are reticulated, and the second [third] quill of their wings is longest. Their sternum (fig. 76) differs from that of other Falcons (see fig. 72) in becoming narrower towards its posterior margin, where a notch exists analogous to the inner emargination of the Gallinazos, but not to the foramen observable in the Falcons generally: the intestine is very slender and of great length (whereas in the Ernes it does not differ from that of other Falcons): the super-orbital bone does not project: the feathers even are completely destitute of the supplementary plume, (which in the Ernes and most other Falcons is considerably developed), and are not lengthened over the tibia: the outer toe is reversible, and the foot astonishingly rough underneath, to enable them to hold their slippery fishy prey, on which they subsist exclusively. This is by far the most strongly characterized division of the Linnæan genus *Falco*.\*]

The Common Osprey (*F. haliaetus*, Lin.)—[Evidently a cluster of a allied species, very generally distributed. That of New Holland (*P. leucocephalus*, Gould) has the crown white. In some places this bird nidificates in large societies.

As a group, externally intermediate to the Ernes and Ospreys, might be separated the *F. ichthyæetus*, Horaf., and several allied species from Australasia. They are essentially Osprey-like Ernes, which most probably retain the anatomy of the latter, and exhibit greater development of the mandibular tooth than either.]

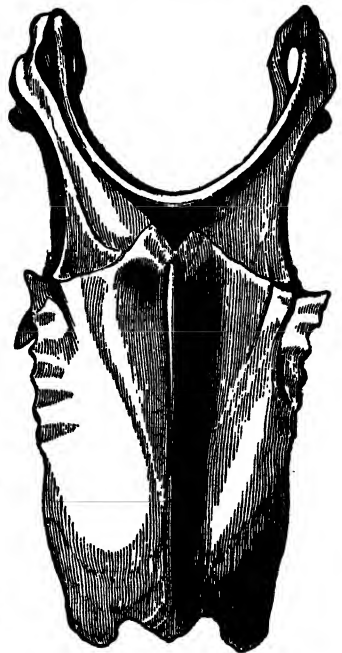


Fig. 76.—Sternum of Osprey.

\* The genus *Herpethotherax* alone is nearly allied.

THE MARSH-EAGLES (*Circætus*, Vieillot).—

Hold a sort of mediate station between the Ernes, the Ospreys, and the Buzzards. They have the wings of the Eagles and Buzzards, and the reticulated tarsi of the Ospreys. Such are

The European Marsh-eagle, or *Jean-le-blanc*, (*F. gallicus*, Gm.),—the beak of which curves more rapidly than in other Eagles, and the toes are proportionally shorter. It exceeds the Osprey in size, and inhabits Europe, preying chiefly on reptiles.

*Le Bateleur* of Le Vaillant, (*F. caudatus*, Shaw).—An African species, remarkable for the extreme shortness of its tail, and its beautifully variegated plumage. [It constitutes the division *Helotarsus* of Smith, synonymous with *Terathopias* of Lesson, differing in several particulars from the others, and particularly in the baldness of its cheeks. The Bateleur preys on young Gazelles, young Ostriches, &c., and also on putrid carrion, disgorging the latter into the throats of its young, as observed of the Vultures.]

America produces Eagles with long wings like the foregoing, and naked scutellated tarsi, in which a more or less considerable proportion of the sides of the head, and sometimes of the throat, is denuded of feathers. The general name of

## CARACARAS—

Has been applied to them. From this group M. Vieillot has made his genera *Deprtus*, *Ibycter*, and *Polyborus*, [partly] according to the greater or less extent of the bare part of the head. [*Phalcobanus*, d'Orbigny, *Gymnops* and *Mikago*, Spix, have also been applied to divisions of the Caracaras. These Birds are carrion-feeders, and pass their time chiefly on the ground, amongst the herbage, where their gait is ambulatory. All are from the warm regions of America.]

THE CORONARDS, or short-winged Fisher-eagles, (*Harpyia*\*, Cuv.; [*Thrasætos*, G. Gray])—

Are also American Eagles, which have the tarsi very thick and strong, reticulated, and half-covered with feathers, as in the Ernes, from which they differ chiefly in the shortness of their wings; their beak and talons are stronger than in any other tribe.

The Harpy Coronard or Eagle (*F. harpyia*, and *F. cristatus*, Lin.).—Of all Birds, this possesses the most terrific beak and talons; it is superior in size to the common Eagle. On the back of its head are elongated feathers, forming a sort of fan-like crest upon the nape, which, when erected, impart to its physiognomy a resemblance to the tufted Owls: like them, also, its external toe is frequently directed backward. It is said to be so strong, as to have sometimes cleft a Man's skull with a blow of its beak. The Sloths are its ordinary food, and it not unfrequently carries off Fawns.

THE EAGLE-HAWKS (*Morphnus*, Cuv.)—

Have, like the preceding, wings shorter than the tail; but their elevated and slender tarsi, and their feeble toes, oblige us to distinguish them. Some have the tarsi naked and scutellated.

The Crested Eagle-hawk of Guiana (*F. guianensis*, Daud.), resembles singularly, in its colours and markings, the Harpy Coronard of the same country; but is not so large, and its naked and scutellated tarsi sufficiently distinguish it.

*F. scrubbinga*, Lin., is crestless. This handsome species hunts in inundated grounds. [Certain other uncrested species, with very long tarsi, constitute the *Limnætos*, Vigors.

Others have elevated tarsi, feathered throughout their length [the *Spizætos* of Vieillot].

The Tufted Black Eagle-hawk of Africa (*F. occipitalis*, Daud.),—inhabits the whole of that continent.

The Variegated Eagle-hawk (*F. ornatus*, Daud.; *F. superbus* and *coronatus*, Shaw: *Harpyia braccata*, Spix, refers to the young).—A handsome species from South America, which varies from black and white to deep brown. [Certain Indian species compose the *Nisætos* of Hodgson.]

Finally, there are in America some Birds with beaks as in all the preceding; very short, reticulated tarsi, half-feathered in front; wings shorter than the tail; but the most distinctive character of which consists in their nostrils, which are almost closed, and resemble a fissure. A small tribe may be made of them, designated

THE CYMINDUS (*Cymindis*, Cuv.).

Such is

The small Cayenne Hawk of Buffon (*F. cayennensis*, Gm.); which has another peculiar character, by possessing a small tooth at the bend of its beak.

[*F. hamatus*, Illiger, ranged by the author in *Cymindis*, composes the *Rostrihamus* of Lesson: its beak very narrow, the upper mandible resembling a long and slender claw: tail slightly furcate.

\* This term was previously applied to a subgenus of *Cheloptera*.—Ed.

THE ASTURINES (*Asturina*, Vieillot).—

Have been generally placed next. They have the nostrils lunulated; the bill straight at its base; wings short, and the tarsi also short and somewhat slender.

*A. cinerea*, Vieillot, a species from Guiana, may be cited in exemplification.]

THE HAWKS (*Astur*, Bechstein; *Dedalion*, Savigny).—

Which form the second division of the *Ignobles*, have wings shorter than the tail, as in the last three tribes of Eagles; but their beak curves from its base, as in all that follow.

THE GOSHAWKS (*Astur*, as restricted).—

Have the tarsi [more distinctly] scutellated, and comparatively short.

The European Goshawk (*F. palumbarius*, Lin.), equals the Jer Falcon in size, but always stoops obliquely on its quarry. Falconers, however, sometimes use it for the weaker kinds of game. It is common in the hilly and secondary mountain ranges of Europe.

Among foreign Goshawks, we may notice that of New Holland (*F. Nova Hollandie*, White), which is often entirely snow-white; but it appears that these white individuals constitute a variety only of a bird of the same country, pale ash-coloured above, white below, with vestiges of pale undulations.

We may approximate to the Goshawk certain American Birds, with short wings and tarsi, the latter reticulated. [These are

THE NICAGUAS (*Herpethotheres*, Vieillot; *Dedalion*, Vigors).—

A strongly characterized division, interesting, as presenting evidently a modification of the peculiar Osprey type, to which genus they alone appear to be allied. It is particularly desirable, therefore, that their anatomy should be ascertained.]

The Nicagua of Azara, or *Laughing Falcon*, (*F. cachinnans*, Lin.): so named from its cry. From the marshes of South America, where it preys on reptiles and fish. [Its colouring, and the texture of its plumage, are the same as in the Osprey; and it has similar short feathers on the tibia. *F. melanops*, Lath, and *F. rufator*, Lin., appertain to this division; the latter, however, constituting the restricted *Physets* of Vieillot.]

THE SPARROW-HAWKS (*Nisus*, Cuv.; [*Accipiter*, Ray]).—

Have longer and more slender tarsi than the Goshawks, [still shorter wings, and the middle toe much lengthened]; but the passage from one to the other of these divisions is almost insensible.

Our common Sparrow-hawk (*F. nisus*, Lin.) has the same colouring as the Goshawk, but is much less in size; notwithstanding which it is employed in falconry. There are foreign species still smaller; but also some that are much larger, as

The Chanting Hawk (*F. musicus*, Daud.),—a native of Africa, where it pursues Partridges and Hares, and builds in trees. It is the only bird of prey known that sings agreeably, [by which, however, cannot be meant that it infects the voice, as in those Passerine Birds which have additional laryngeal muscles. This bird,—and there is more than one species here confounded,—has a much weaker bill, and longer wings, than the true Sparrow-hawks; it has probably been made the type of a separate division.

The *Gymnogenys* of Vieillot may also be introduced here. It is a Hawk with very long wings, lengthened and distinctly scutellated tarsi, and short toes, but the most distinctive character of which consists in its being naked above the bill and on the cheeks. The only species, *G. madagascariensis*, is grey, with round black spots on the wings, and the lower parts below the breast transversely rayed: it bears some resemblance to the Secretary.

The species of Hawks displays the maximum sexual disparity of size, in favour of the female.]

THE KITES (*Milvus*, Bechst.).—

Have short tarsi, and feeble toes and claws, which, added to a beak equally disproportioned to their size, render them the most cowardly of the whole group: they are further distinguished by their excessively long wings, and by their forked tail, in consequence of which their flight is very swift and easy.

Some have the tarsi very short, reticulated, and half-feathered above, like the last small tribe of Eagles: [their claws, save that on the middle toe, are rounded underneath]. Such are

THE ELANETS (*Elanus*, Savigny).

The Black-winged Elanet (*F. melanopterus*, Daud.); a common species from Egypt to the Cape, and which appears to be found in India, and even in America. [The American and New Holland species are distinct.] Insects are almost its sole prey.

The Swallow-tailed Gledo (*F. fuscatus*, Lin.).—Larger than the preceding, [with wings excessively long, and tail

deeply furcate]. It attacks reptiles [and the larger insects, and has been known to scrape out Wasps'-nests like the Pern. Its talons are not rounded underneath, on account of which, together with other distinctive characters, it is now generally recognised as constituting the *Nauclerus*, Vigors. This bird is indigenous to America, but has been known to stray into Britain. It is social in its habits, and almost gregarious. A nearly allied African species constitutes the *Elaenoides* of Vieillot.]

#### THE KITES, properly so called (*Milvus*, Cuv.)—

Have the tarsi scutellated and stronger, [and are very nearly related to the *Erænes*].

The Common or Red Kite (*F. milvus*, Lin.).—Of all European Birds, this remains longest and most tranquilly on the wing. It scarcely attacks any thing but reptiles. [Another European species, not hitherto found in Britain, where the first is fast disappearing, is

The Black Kite (*M. ater*, Gm.).—The author has likewise ranged here

The American Puttock (*F. plumbeus*, Lath.), or the *Mississippi Kite* of Wilson, which is referrible to Vieillot's genus *Ichiaea*, now generally accepted. This forms an obviously distinct group, the members of which are much more powerfully armed than the Kites, having a short and stout beak, the upper mandible of which is somewhat angularly festooned, and talons comparatively developed. They prey, however, principally on the larger insects, and occasionally on Snakes and Lizards: are most nearly related to the *Elaenoids*.]

#### THE PERNS (*Pernis*, Cuv.)—

Or *Honey Buzzards*, combine, with the weak bill of the Kites, a very peculiar character, in having the space between the eye and beak, which in the rest of the genus *Falco* is naked, and only furnished with some [radiating] bristly feathers, covered with close feathers disposed like scales; their tarsi are half-feathered above, and reticulated; their tail even; wings long, [the third quill being longest]; and their beak curved from its base, as in all that follow.

The Common Pern (*F. apivorus*, Lin.) pursues insects, and principally Bees and Wasps, [the combs of which it scratches out of banks to feed on the maggots: in default of these, however, it will attack small warm-blooded animals and reptiles. It runs with celerity on the ground; is migratory; and generally builds on the tops of lofty beeches. Two or three additional species have been ascertained, all from the Eastern Continent].

#### THE BUZZARDS (*Buteo*, Bechstein)—

Have long wings, the tail even, the beak curved from its base, the interval between it and the eyes without feathers, [at least such as the Perns exhibit], and the feet strong.

Some of them have the tarsi feathered to the toes [the *Buteo*, Lesson]. They are distinguished from the Eagles by having the beak curved from its base, and from the Hawks and Eagle-hawks by their feathered tarsi and long wings. Europe possesses one,

The Rough-legged Buzzard (*F. lagopus*, Lin.), [of which *F. Sancti Johannis*, Auct., appears to be merely the old individuals.\*]—One of the most widely diffused of Birds, being found almost everywhere. [It frequents marshy tracts, and particularly rabbit-warrens, which it beats till very late in the evening.]

But the greater number of Buzzards have the tarsi naked [except on the upper half in front] and scutellated. In Europe there is but one,

The Common Buzzard (*F. buteo*, Lin.).—The commonest and most noxious bird of prey throughout Europe. It remains all the year in the forests, descends upon its prey from the top of a tree, and destroys much game.

Some species are created, [have also naked cheeks, and reticulated tarsi. They are barely separable from the *Circæti*.

#### THE HEMATORNS (*Hematornis*, Gould)].

*F. bache*, Auct.—A very savage bird of Africa, which preys chiefly on the *Hyænas*. [Other naked-checked Buzzards compose the *Buteogallus*, Lesson.]

#### THE HARRIERS (*Circus*, Bechst.)—

Differ from the Buzzards in their more elevated [and very slender] tarsi, and by a sort of collar, which the tips of the feathers which cover the ear form on each side of the neck. [These Birds frequent open moorlands, over which they skim in search of prey very close to the ground, and nestle and always roost on its surface.†]

\* We have seen a British-killed specimen as dark as any from America.—Ez.

† Some systematists consider the Harriers to form a link from the Falcons generally to the Owls; but neither in the skeleton, as shown

by the sternal apparatus (fig. 73), nor in their digestive organs, do they approximate the latter in the least degree. The structure of the ear, resembling that of other Falcons, is shown at fig. 27. They are most nearly related to the Kestrels.

There are only three species in France, which have been multiplied by the nomenclators on account of the variations of their plumage. [The Common, Montagu, and Marsh Harriers are alluded to; besides which the *C. pallidus*, an abundant Asiatic species, has recently been met with in the east of Europe. There are numerous others.]



Fig. 77.—Head of Harrier.

Finally,

THE SECRETARY (*Gypogeranus*, Illig.),—

Is an African bird of prey, the tarsi of which are at least double the length of those of the preceding, which has induced some naturalists to range it among the Waders; but its thighs, entirely covered with feathers, its hooked beak, projecting eyelids, and all the details of its anatomy, concur to place it in the present order. Its tarsi

are scutellated, the toes proportionally short, and the circumference of the eyes naked; it has a long rigid crest on the occiput, and the two middle feathers of its tail extend far beyond the others. An inhabitant of the arid and covertless plains in the neighbourhood of the Cape, it pursues reptiles on foot, whence its claws become much worn. Its principal strength is in the foot. It is the

*Falco serpentarius*, Gm.—An attempt has been made to multiply the breed in Martinique, where it might render the most important service by destroying the lance-headed Vipers which infest that island. [This bird, two if not three species of which are recognized, resembles the Vultures in having fifteen cervical vertebrae. It offers no molestation to poultry or other warm-blooded animals.]

Although a vast number of generic and subgeneric names have been applied, the DIURNAL BIRDS OF PREY may be reduced to comparatively few natural divisions. After detaching the Vultures and the Secretary, the genera *Pandion* and *Herpethotheres* may be signalized as forming a particular subdivision apart from all the rest. The whole of the remainder then form an equivalent natural group, the members of which scarcely differ anatomically. The most distinct subdivision is that of the Coronards, which alone differ in the number of pelvic vertebrae, and in having the outer toe reversible, as in the Ospreys and Owls. The rest are little else than adaptive modifications of one another, according in all their rudimental characters. We may commence with the Falcon group, followed by that of the Hawks (or the subdivisions *Dadalon*, *Asturina*, *Astur*, *Accipiter*, and *Gymnogenys*); the Harriers naturally succeed, which lead by *C. aeruginosus* to the Ernies, and then to the Kites (*Milvus*, as restricted); probably the Buzzards and Eagles, which are but arbitrarily separable, should next range, merging into the Eagle-hawks; or perhaps the Perns, followed by the Elanet group (including *Ictinia*). We are less satisfied of the affinities of the Caracaras, of the Cyndindues, and of the Marsh-eagles and Hæmatorns, which last group seems to approximate that of the Hawks.]

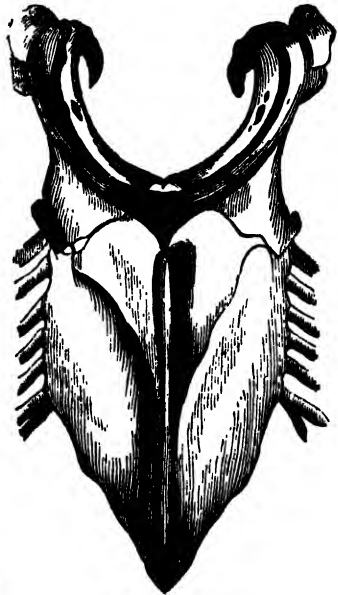


Fig. 78.—Sternum of Secretary.

THE NOCTURNAL BIRDS OF PREY

Have the head large; very great eyes, directed forwards, and surrounded by a circle of fringed feathers, the anterior of which cover the cere of the beak, and the posterior the orifice of the ear. Their enormous pupils permit so much light to enter, that they are dazzled in full day. Their skull, inflated, but of a slight substance, contains large cavities that communicate with the ears, and probably assist the sense of hearing; but their apparatus for flight is feeble, the furcula offering but slight resistance: their feathers, with soft barbs, and delicately downy, make no noise in flying. The external toe can be voluntarily directed forward or behind. These Birds fly



chiefly during twilight, or by the light of the moon. When attacked by day, or struck by the appearance of some new object, they [the majority of them] do not fly off, but stand more erect, assume grotesque attitudes, and make the most ludicrous gestures.

Their stomach is tolerably muscular, [as compared with the Falcons,] although their prey is wholly animal, consisting of Mice, small birds, [even fish in some instances,] and insects; but is preceded by a large craw, [an inadvertent statement of the author, as the absence of any expansion of the gullet, which is wide, but always of uniform diameter (see fig. 79 a), invariably distinguishes the *nocturnal* from all the *diurnal* birds of prey]; the ceca (b) are long, and enlarged towards the extremity, &c. Small Birds have a natural antipathy to them, and assemble from all parts to assail them; hence they are employed to attract Birds to the snare. [It may be added, that their tarsi are in no instance scaled, even when denuded of feathers, as in the subdivision *Ketupa*; all of them lay round white eggs.] They form one genus, that of

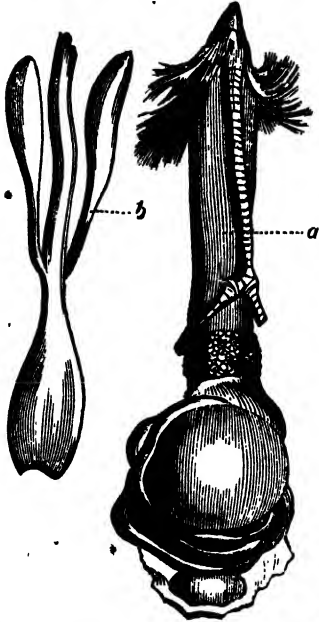


Fig. 79.—Alimentary canal of an Owl: a, the gullet, devoid of any craw; b, the ceca.

#### THE OWLS (*Strix*, Linn.),—

Which may be divided according to their head-tufts, the size of their ears, the extent of the circle of feathers which surrounds their eyes, and some other characters.

Those species which around the eyes have a large complete disk of fringed feathers, itself surrounded by a circle or collar of scaly feathers, and between the two a large opening for the ear (see fig. 80), are more removed in their form and manners from the diurnal Birds of Prey, than those in which the ear is small, oval, and covered by fringed feathers which come from below the eye. Traces of these differences are perceptible even in the skeleton, [though only as regards the degree of stoutness of the bones (see figs. 81 and 84), there being no gradation or transition into the Falcons, either in the skeleton or digestive organs.

The following arrangement of the Owls, based on the comparative size of the aperture of the ear, is liable to the objection of dispersing some nearly allied groups, and approximating others that are less so, which is almost necessarily the result of too exclusive attachment to any single character.]

Among the first species, we will distinguish

#### THE HIBOUX (*Otus*, Cuv.),—

Which have two tufts of feathers (vulg. *horns*) which they can erect at will, and the ear-conch of which (fig. 80), extends in a semicircle from the beak almost to the top of the head, and is furnished anteriorly with a membranous operculum. Their feet are feathered to the toes. Such, in Europe, are

The Long-tufted Hibou (*Str. otus*, Lin.).—Very widely distributed; it inhabits woods, especially those of fir and other ever-greens, and breeds generally in deserted Crows' nests: and

The Short-tufted Hibou (*Str. brachyotus*, Lin.).—Found almost every where, [if indeed the same species, which there is reason to doubt: it inhabits open moors, breeds on the ground, and exhibits trifling sexual disparity of size. This bird is scarcely, if at all, dazzled by sun-light: it is the *Brachyotus pajustrie* of Gould].



Fig. 80.—Ear of Hibou, as observed by raising its anterior flap.

We apply the designation of

• Copied from M. McGillivray's *Rapacious Birds of Britain*.



### HOWLERS (*Uhula*, Cuv.)—

To the species which have the beak and ear of the Hiboux, [the latter, however, less developed (see fig. 83)], but not the tufts. They are to be found in the north of both continents: for example,

The *Cinereus* Howlet (*Str. lapponica*, Gm.).—Almost as large as our Bubow. It inhabits the mountains of the north of Sweden, [and Arctic America].

The Barred Howlet (*Str. nebulosa*, Gm.).—[A common bird of North America, very rare in Europe.]

### THE RESTRICTED OWLS (*Strix*, Savigny)—

Have ears as large as in the Hiboux [but of a very different form], and furnished with a still larger operculum; but their elongated beak is only bent towards the end, while in all the other subgenera it curves from the point. They have no head-tufts; their tarsi are feathered [and rather long], but they have hairs only upon the toes: [their middle claw is obtusely serrated: their sternum (fig. 81), shorter than in the others, has its inner notch very slight, and often obliterated.] The mask, formed by the fringed feathers that surround the eyes, is greatly extended, which renders their physiognomy more extraordinary than that of any other night-bird. The species common in France,

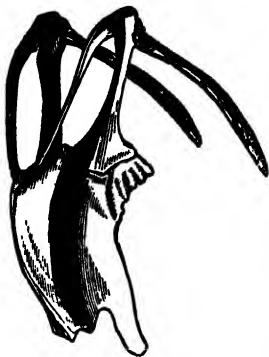


Fig. 81.—Sternum of Barn Owl.

not shed before the second autumn. This curious and handsome bird is naturally familiar, and eminently worthy of protection; as it preys solely on small quadrupeds and insects.]

### SYRNIUM, Savigny.

The disk and collar of the preceding; but the conch (fig. 83) reduced to an oval cavity, that does not extend to half the height of the skull; they have no head-tufts, but their feet are feathered to the talons. [Notwithstanding the authority of Cuvier, it is proper to remark, that there is no appreciable difference between this and *Uhula*,—certainly none of generical importance. The *Bulaca* of Hodgson appears also to be synonymous.]

The Tawny Howlet (*Strix aluco* and *stridula*, Lin.).—A common European bird, which nestles in the woods, or frequently lays its eggs in the [deserted] nests of other Birds, [though more commonly (if not always) in the hollows of trees, where it abides by day. It is the species so well known for its sonorous hootings. The young are clad at an early age with downy feathers, which are succeeded by the adult plumage previous to their first winter. Their parents often feed them with fish.]

### THE BUBOWS (*Bubo*, Cuv.)—

Are species which, with as small a conch, and the disk of feathers less marked than in the preceding, possess head-tufts. The known species have great feet, feathered to the talons. [They differ from the Hiboux only in their superior size, and the smallness of the auditory aperture.] Such is

The European Bubow (*Str. bubo*, Lin.), or the *Great-horned* or *Eagle-owl*.—The largest of nocturnal Birds [or



Fig. 82.—Barn Owl.

which is exceeded in size only by others of this genus. It is little less than the Golden Eagle, and very destructive to Grouse, Hares, and even Fawns: inhabits the mountainous parts of Europe, and is seldom seen in Britain.] Add

The American Bubow (*Str. virginiana*, Dand.)—[Smaller than the preceding, with the grey colour predominating over the fulvous: the Arctic Eagle-owl of the *Fauna Americana-borealis* appears to be only a semi-albino variety. Another species is

The Small-tufted Bubow (*Str. ascalaphus*, Savigny), inadvertently placed by the author in his division *Otus*. It is proper to Asia and Africa, and is occasionally met with in the south-east of Europe. There are several more, certain of which appear to compose the *Hukua* and *Urrhua* of Hodgson.]

Other species occur, in which the aigrettes, wider apart and placed further backward, are elevated with less facility above the horizontal line. Species occur in both continents: as

*Str. griseata*, Shaw, from Galana; and *Str. streptians*, Tem., from Batavia.

#### NOCTUA\*, Savigny.

Neither tufts, nor an open and deeply set cone to the ear; the aperture of which is oval, and scarcely longer than in other Birds: the disk of fringed feathers is smaller and even less complete than in the Bubows. Their relations to the diurnal Birds of prey are evident, even in their habits, [but not in their internal conformation].

Some are remarkable for a long cuneiform tail, and have their toes densely feathered. They are

#### THE SURNS (*Surnia*, Dumeril)—

The Rayed Surn (*Str. nisoria*, Wolf; *Str. fuscescens*, Lin.).

—This, the best-known species, from the north of the whole globe, is about the size of the Sparrow-hawk. It hunts more during the day than the night.

The species of the Uralian mountains (*Str. uralensis*, Pallas), is nearly as large as the Harfang. It also hunts during the day, and is sometimes seen in Germany. It is probably the *Hybris* or *Ptynx* of Aristotle.†

There is a species termed Arcadian (*Str. acadica*, Naum), but which belongs to the whole north of the Globe [?] It is the smallest of its tribe, being hardly larger than a Sparrow. It does not avoid the light of day; but Le Vaillant has made known another, from Africa (*le Choucou*, No. xxxviii.), which, according to his account, is very nocturnal. [The former is the *Str. passerina* of Linnaeus, but not of British authors, and the *Str. acadica* of Temminck, but not of Gmelin; it is referrible to the *Glaucidium* of Boie, and is not found in America: the *Str. acadica*, Gm., is peculiar to America, and pertains to a very different subdivision, *Nyctale* of Brehm, the members of which are considerably more nocturnal in their habits and adaptations. To the latter group the Choucou of Le Vaillant should also probably be referred. *Ninox* of Hodgson seems to be identical with *Glaucidium*.]

Others have the tail short, and the toes densely feathered: the largest of which, and also the largest night-bird without head-tufts, is

The Harfang (*Str. nyctea*, Lin.), or Great Snowy Owl, which almost equals the European Bubow in its dimensions. It inhabits the north of both continents, nestles on elevated rocks, and preys on Hares, Capercaillies, and Ptarmigan. [This bird forms another very distinct division, and is most nearly allied to the Bubows: like them, it does possess head-tufts, which however are small and inconspicuous, though we have seen the bird erect them; its plumage is remarkably firm. The term *Nyctea*, Swainson, has been generically applied to it, with the specific appellation *candida*.]

\* This term is falling into disuse, from its having been previously bestowed on a group of insects: it is moreover far from being felicitous, as applied to the most diurnal of the Owls.—Ed.

† The Prince of Musignano places this remarkable bird in *Syrnium*. I have never seen a specimen, but—to judge from Mr. Gould's figure

of it, in the *Birds of Europe*,—should be disposed to elevate it to the rank of a separate division (*Ptynx*); its large and complete ruff distinguishes it from *Surnia*, as its accipitrine form and lengthened tail do from *Syrnium* or *Ustula*.—Ed.



Fig. 83.—Howlet's Ear.



Fig. 84.—Skull of Harfang.

There are others very much smaller,—such as

*Str. Tengmalmi*, Gm.—[These have an extended auditory conch, as in the Howlets, like which they are very nocturnal, and unable to endure the light of day. The *Nyctale* of Brehm. The species indicated is peculiar to the Eastern Continent, that confounded with it in the fur-countries of North America, *Str. Tengmalmi*, Richardson, being now dedicated to its enterprising discoverer.]

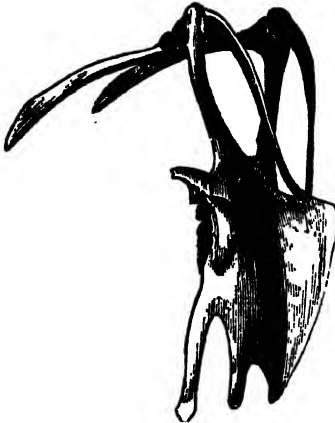


Fig. 85.—Sternum of Howlet.

*Str. Spix*; and *Str. torquata*, Daud.—The two first of these equal in size the Tawny Howlet, and the last is still larger.

But the greater number of these small species have only a few scattered hairs on the toes, [and are nearly allied to the true Surns. They are the *Athene*, Boié]. Such is

*Str. passerina*, Gm. [and of British authors; *Str. noctua*, Lin.; *Athene noctua*, Bonap.]—It nestles in old walls, [and frequently in chimneys, and has been seen to pursue Swallows on the wing. A remarkable exotic species, with very long tarsi, is the

*Str. cunicularia*, Molina, or the *Burrowing Owl*, as it has been called; but which, it is most probable, only appropriates the dwellings of burrowing quadrupeds, as the Barn Owl is known to do under similar circumstances; the present species inhabiting the open prairies of America, where there are no trees, and abounding in the villages of the Prairie Marmots, as also in the burrows of the *Viscachas*].

There are yet other *Noctua* with unfeathered toes, which approximate the Howlets in size. Cayenne supplies several fine species, and particularly the three following:—

*Str. cayennensis*, Gm.; *Str. lineata*, Shaw, or *Str. albomarginata*,

Finally, there are some in America, which have the tarsi, in addition to their toes, denuded of feathers; of which the

*Str. nudipes*, Daud., may be cited in illustration.

#### THE SCOPS (*Scops*, Savigny).—

With ears proportioned to the size of the head, the incomplete disk and naked toes of the preceding, combine aigrettes analogous to those of the Bubows and Hiboux.

One inhabits Europe (*Str. scops*, Lin.).—Scarcely larger than a Blackbird, [and there are many others].

Some foreign species occur of rather large size, with the legs, as well as the toes, naked. [They constitute the subdivision *Ketupa*.] Such are

*Str. Ketupa*, Tem., and *Str. Leschenaulti*, Id., which may possibly prove to be identical. [These Birds are essentially Bubows, with long and naked tarsi, the skin of which corrugates in dry specimens, so as to present somewhat the appearance of being covered with reticulated scales, which is not the case. Their toes are very rough underneath, as in the Ospreys; and like them they prey chiefly on fish, and sometimes crustaceans. The *Culturungus* of Hodgson appears to be a synonyme of this subdivision.

The great group of Owls falls naturally into three distinct sections, distinguishable at the first glance; and two of these sections comprehend species which differ exceedingly in the magnitude of the external ear.

The first comprises all that are decorated with aigrettes, or what are popularly termed *Horned Owls*: as the divisions *Nyctea*, *Bubo*, *Ketupa*, *Scops*, and *Otus*.

In the second section, the whole of the tuftless species should be brought together, excepting those constituting the subdivision *Strix* of Savigny. They mainly differ in their degrees of adaptation for nocturnal or semi-diurnal habits.

The third is composed of the restricted genus *Strix*, or the Barn Owls, and is much more distinct from both the others, than the latter are *inter se*. The aspect of the living bird is very different in these three primary sections.]

## THE SECOND ORDER OF BIRDS.

## THE PASSERINÆ.

This is the most numerous order of the whole class. Its character seems, at first sight, purely negative, for it embraces all those Birds which are neither swimmers, waders, climbers, rapacious, nor gallinaceous. Nevertheless, by comparing them, a very great mutual resemblance of structure becomes perceptible, and particularly such insensible gradations from one genus to another, that it is extremely difficult to establish the subdivisions.

They have neither the violence of the Birds of Prey, nor the fixed regimen of the Poultry and Water-fowl; insects, fruit, and grain, constitute their food, which consists more exclusively of grain as the beak is stouter and stronger, and of insects as it is more slender. Those in which it is strong even pursue other Birds.

Their stomach is a muscular gizzard. They have, generally, two small cœca: and it is among them that we find the singing Birds, and the most complicated inferior larynx.

The proportional length of their wings and the power of their flight are as various as their habits.

The adult sternum has ordinarily but one emargination on each side of its posterior border. There are, however, two in the Rollers, Kingfishers, and Bee-eaters, [also in the Colies, Motmots, and Todies, which the author includes in this group.] and none whatever in the Swifts and Humming-birds.

We institute our first partition according to the feet, and have then recourse to the beak.

The first and most numerous division comprehends those genera in which the external toe is connected to the middle one as far as the first or second joint only.

[This ordinal subdivision, properly restricted, is one of the most rigorously defined throughout nature, quite as much so as that of the Parrots.

The entire skeleton, digestive and vocal organs, are peculiar; and those genera included by the author which differ in one particular differ also in the rest, and accord in all their essential characters with another great group that follows.

The lower larynx is always complicated, and operated upon by four distinct pairs of muscles; besides which, the long sterno-tracheal pair—found in most other Birds—is generally present, but reduced to extreme tenuity. This character excludes the Cuvierian genera *Cypselus*, *Caprimulgus*, *Podargus*, *Colius*, *Coracias*, *Colaris*, *Upupa*, *Merops*, *Prionites*, *Alcedo*, *Ceyx*, *Todus*, and *Buceros*,—ten of which have also no intestinal cœca, and the three others very large cœca, exactly resembling those of the Owls (fig. 79). All the remaining genera, except the Humming-birds, which also require to be excluded, have two minute cœca.

With the sole exception again of the Humming-birds, which have the lower larynx differently complicated, all *singing Birds* belong to this great order: the conformation alluded to enables them to inflect and modulate the voice; though there are many species, possessing the same structure, which nevertheless utter only monotonous cries, and others of which the notes are harsh and little varied; even these, however, are very generally capable of being taught to speak, to whistle airs, and to imitate almost any sound; and in such individuals as cannot be brought to do so, it by no means follows that there is any physical deficiency, as indicated by the diversity noticeable in this respect in individuals of the same species: there are indeed very few of them, if any, that do not *sing*, or utter some peculiar note or chatter analogous to song, during the season of courtship.

The sternal apparatus, whether of a Swallow or Tree-creeper, a Promerops, Finch, Crow, Thrush, or Manakin, presents invariably the same peculiar characters, with scarcely any modification. The long manubrial process in front between the coracoids, with slantingly truncate bifurcate tip; the costal process, expanding anteriorly much beyond the articulations of the

ribs; the single deep and angular posterior emargination, reduced to a foramen in some; the long, slender, and curving furcula, with invariably a compressed *vertical* appendage;—all are

characters that at once indicate the present order, and exclude every one of the genera that have been enumerated.

They have constantly a large brain, and characteristic form of skull, excepting in one genus\*; twelve tail-feathers, another character which excludes the genera *Cypselus*, *Caprimulgus*, *Podargus*, *Colius*, *Upupa*, *Trochilus*, and *Buceros*; and their clothing feathers have rarely any trace of the supplementary plume, which is never developed beyond a few downy filaments. All of them are

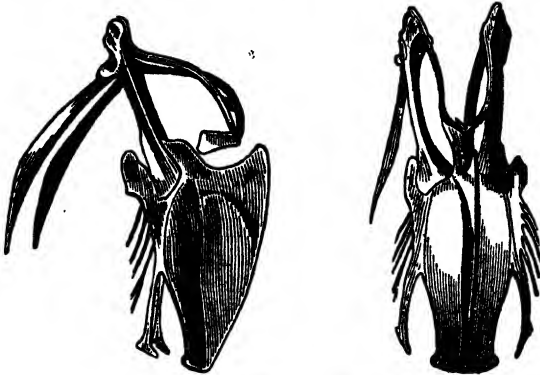


Fig. 55.—Sternum of Haw Grosbeak.

hatched naked, and in nearly every instance from coloured or speckled eggs, larger at one end, and in a nest constructed and generally *interwoven* by the parents,—extremely few other Birds doing more than heaping together a quantity of materials.

The toes are formed for perching; and are always three before and one hindward, the outward and middle toes being in every instance connected to the first joint, and sometimes further.]

The first family of this division is that of

#### THE DENTIROSTRES,—

Wherein the upper mandible is notched on each side toward the point.† It is in this family that the greatest number of insectivorous Birds occur; though many of them feed likewise on berries and other soft fruits.

The genera are determined by the general form of the beak, which is stout and compressed in the Shrikes and Thrushes, flattened in the Flycatchers, round and thick in the Tanagers, and slender and pointed in the Pettychaps group; but the transitions from one to another of these forms are so gradual that it is very difficult to limit the genera.

[The study of the changes of plumage, and even colours and markings, affords considerable assistance in determining the affinities of the various genera,—more so, perhaps, than any other character.]

#### THE SHRIKES (*Lanius*, Lin.)—

Have a conical or compressed beak, more or less hooked at the point‡

#### THE SHRIKES, properly so called, (*Lanius*, Vieillot)—

Have it triangular at the base, with compressed sides. They live in families [for a few weeks after the breeding season], fly irregularly and precipitately, uttering shrill cries; nestle on trees [or in bushes]; lay five or six eggs, and take great care of their young. They have the habit of imitating, in the wild state, part of the songs of such Birds as live in their vicinity. The females [?] and young are generally marked with fine transverse lines on the upper parts.

Some have the upper mandible arched; those in which its point is strong and much hooked, and in which the notch forms a small tooth on each side, manifest a degree of courage and cruelty which has led to their association with the Birds of Prey by many naturalists. In fact, they pursue other Birds, and successfully defend themselves against the larger ones, even attacking the latter whenever they intrude in the vicinity of their nest.

\* *Melurus*; the different species of which are singularly variable! † No trace of this notch is ever visible in the bone, from which the "tooth" of certain *Acridotheres* is a true process.—Ed.

There are four or five species of this subdivision in Europe, as

The Sentinel Shrike (*L. excubitor*, Lin.).—As large as a Thrush, and ash-coloured above, white underneath: the wings, tail, and a band crossing the eyes, black; some white on the scapulars and tail. It resides all the year in France, [and is chiefly known as an uncommon winter visitant in Britain].

The Red-backed Shrike (*L. collurio*, Gm.).—Smaller, with the head and rump ash-coloured, the back and wings reddish-brown, a black streak through the eyes, lower parts whitish, tinged with pinkish lilac, wings and tail dull black, the side feathers of the latter white at the base externally. [Female, brown above, without transverse striae, and sometimes attaining the masculine livery with age.] It destroys other Birds, young Frogs, and a vast number of insects, which it impales on the thorns of bushes, to devour at leisure, [a habit common to the whole genus, whence they have derived the name of *Butcher-birds*. We may here remark that the Shrikes have great power of clutching with their toes, and always hold their prey in one foot, resting on the tarsal joint of that foot, unless when they have fastened it upon a thorn, when they pull it to pieces in a contrary direction. The present species feeds much on small mammalia, as Shrews and the smaller Voles, captures insects on the wing in the manner of a Flycatcher, and is a common summer visitant in the southern counties of England].

The Wood Shrike (*L. rufus*, Gm.).—Wings and tail nearly as in the preceding, the band across the eyes meeting over the forehead, the head and neck bright rufous, back black, the scapulars, rump, and lower parts, white. [Sexes almost similar. A summer visitant, of very rare occurrence in Britain. There are two others in Europe, allied to the first, *L. minor*, Gm., and *L. meridionalis*, Tem.; and many more in Asia, Africa, and America, some of the former having shorter wings, and a longer and more cuneated tail.]

There are numerous exotic species with arcuated beaks, the points of which diminish by degrees, till it becomes impossible to define the limits between them and the Thrushes.

The genus *Lanio* of Vieillot is founded on one of them, the edges of the upper mandible of which are slightly angular. It is the *Tangara mordax* of Buffon, (*Tan. atricapilla*, Gm.)

Various species with feeble bills constitute the *Laniarius* of Vieillot. (*Gal. Ols.* 143.)

The Vireoles (*Vireo*) of the same naturalist chiefly differ in the shortness and slenderness of the bill. [They constitute a very distinct genus, consisting of the warbling Flycatchers of North America, as *Muscicapa olivacea*, Wils., and many proximate species, which are allied to the Pitychaps group (the restricted *Sylvia*, or *Phylloscopus*) of Europe: they are to a considerable extent baccivorous.]

Other Shrikes have the superior mandible straight, and abruptly hooked at the tip. They are all foreign, and grade towards the Fauvettes and other slender-billed *Dentirostres*.

[They constitute the *Thamnophilus* of Vieillot, as now generally accepted, wherein the plumage is soft and puffy, and conspicuously barred across at all ages, these markings being in some instances broken into spots, as in the nestling dress of the Thrushes, to which and the true Shrikes they are intermediate, passing to the Thrushes through *Ianthocincla*. They are also related to the Antcatchers, and are indigenous to South America].

Some of them have a straight and very strong beak, the lower mandible of which is much inflated;

As *L. lineatus*, Leach, (*Zool. Misc.* pl. vi.), *Thamnophilus guttatus*, Spix.

Others, again, with a straight and slender bill, are remarkable for their crests of vertical feathers;

As *L. plumatus*, Shaw; of which Vieillot makes his genus *Prionops*, and *le Manicup* of Buffon (*Pipra albifrons*, Gm.), which has nothing in common with the true *Pipra*, beyond a more than usually prolonged junction of the two outer toes. M. Vieillot makes of it his genus *Pithys*. (*Gal.* 129.)

Among these Shrikes, more particularly so called, some other exotic subgenera, that differ more or less, require to be specified. Such are

THE VANGAS (*Vanga*), Buffon,—

Distinguished by a large beak, very much compressed throughout, its tip strongly hooked, and that of the lower mandible bent downward.

The Vanga (*L. curvirostris*, Gm.), and also some newly-discovered species, as *V. destructor*, Cuv., &c.

THE LANGAREYS (*Ocypterus*, Cuv.; *Artamus*, Vieillot)—

Have the beak conical and rounded, without any ridge, somewhat arched towards the tip, with a very fine point, slightly emarginated on each side. Their feet are very short, and the wings in particular reach beyond the tail, which renders their flight similar to that of a Swallow; but they have the courage of the Shrikes, and do not fear to attack even the Crow.

Numerous species inhabit the coasts and islands of the Indian Ocean, where they are continually seen on the wing, flying swiftly in pursuit of insects.\* [They are unquestionably allied to the following.]

THE BARITAHS (*Baritta*, Cuv.; *Cracticus*, Vieillot)—

Have a large and straight conical beak, round at its base,—where it extends circularly backward upon

\* Consult a monograph of this genus, by M. Valenciennes, published in *Mém. du Mus.*, tom. vi. p. 30.

the forehead, occupying the site of the frontal feathers,—laterally compressed, and emarginated. The nostrils, small and linear, are not surrounded by a membranous space.

They are large birds of Australia and the neighbouring islands, which naturalists have arbitrarily dispersed in several genera. They are said to be very noisy and clamorous, and pursue small Birds: [are also docile, and readily learn to whistle airs with remarkable power and execution].

#### THE CHALYBEANS (*Chalybeus*, Cuv.)—

Have the beak similar to that of the Baritahs, except that it is rather less thick at the base, and the nostrils are pierced in a large membranous space. The known species are indigenous to New Guinea, and are remarkable for their fine tints, resembling burnished steel.

The Paradisean Chalybean (*C. paradiseus*, Cuv. ; *Paradisaea viridis*, Gm.).—The feathers on the head and neck like curled velvet, which, together with the lustre of its hues, has caused it to be ranked among the Birds of Paradise.

The Tufted Chalybean (*C. cornutus*, Ill. ; *Baritta Keraudrenii*, Lesson).—Two pointed tufts of feathers on the occiput ; and the trachea forms three circles before it reaches the lungs.\*

#### THE PSARAS (*Pearia*, Cuv. ; *Tetyra*, Vieillot).—

Have a conical beak, very thick, and round at its base, but not extending backward upon the forehead ; the point is slightly compressed and hooked.

The species inhabit South America, and that best known is

The Cayenne Psara (*Lanius cayanus*, Gm.), which is ash-coloured, with the head, wings, and tail, black. Its manners resemble those of the Shrikes. There are many others.

#### THE CHOUCARIS (*Graucacus*, Cuv.)—

Have the bill less compressed than in the Shrikes, the ridges of its upper mandible sharp, and regularly arcuated throughout its length ; the commissure of the beak is slightly arched. The feathers which sometimes cover the nostrils have occasioned them to have been approximated to the Crows, but the emargination of the beak removes them from that genus [?]

They inhabit, like the Baritahs, the remotest parts of the Indian Ocean. Some have very brilliant plumage, and compose the *Pirola* of Temminck, or *Ptilonorkynchus*, Kuhl, founded on the head-feathers being more like velvet. *Sphæcotheres*, Vieillot, only differs from the others in being rather more naked round the eyes.

To the Choucaris may be approximated one of the most beautiful of the birds lately discovered in those regions, the *Coracias puella*, Lath. ; *Irena puella*, Horsf. ; *Drongo azure*, Tem. ; a Javanese species, of a velvet black, the back of which is of the most splendid ultramarine blue that can possibly be imagined.

#### THE BETHULES (*Bethylus*, Cuv. ; *Cissopus*, Vieillot).

The beak thick, short, uniformly bulging, and slightly compressed towards its tip.

We know but of one, which has the form and colours of our common Magpie—(*Lanius leverianus*, Shaw ; *L. piceatus*, Latham).

#### THE FALCONETS (*Falcunculus*, Vieillot).—

Have a compressed beak, almost as high as long, with the ridge of the upper mandible arcuated. [They are merely Tits, with a somewhat shrike-like bill, and resemble our common *Par* in their manners, notes, nidification, eggs, and plumage].

The Crested Falconet (*Lanius frontatus*, Latham).—Size of a Sparrow, and nearly the same colours as our common Great Tit: the coronal feathers of the male form a crest. It inhabits New Holland. [Some of the *Malaconoti* are nearly allied.]

#### THE PARALOTES (*Pardalotus*, Vieillot).—

Have a short beak, slightly compressed, the upper mandible with a sharp arcuated ridge, and its tip emarginated. They are very small birds, with a short tail.

The best-known species (*Pipra punctata*, Shaw), is partly sprinkled with white, like an Amadavat. From New Holland, [where there are many others].

#### THE FLYCATCHERS (*Muscicapa*, Lin.)—

Have the beak horizontally depressed, and armed with bristles at its base, with the point more or less decurved and emarginated. Their general habits are those of the Shrikes ; and, according to their size, they prey on small Birds or Insects. The most feeble of them pass by insensible gradations into the slender-billed warblers. We divide them as follow.

\* This is the only modification of the trachea we have heard of among the *Passerina*.—Ed.

THE TYRANTS (*Tyrannus*, Cuv.)—

Have a long, straight, and very stout bill; the ridge of the upper mandible straight and blunt; its point abruptly hooked. They are American birds, of the size of our Shrikes and equally spirited, which defend their young even against Eagles, and drive all Birds of prey from the vicinity of their nest. The largest species prey on smaller birds, and do not always disdain those they find dead. [They have even been observed to plunge after fish in the manner of a Kingfisher; and have been sometimes noticed to throw up their food and catch it in the throat, as in the Toucans, Hornbills, &c.]

The species are extremely numerous, and have been further subdivided by different systematists. Thus, several with extremely furcate tails compose the *Milvulus*, Swains., and the smaller and weaker species the *Tyrannula* of the same nomenclator: the latter grade into the Kinglets. Others constitute the *Platyrynchus*, Vieillot, &c. The majority have yellow or red coronal feathers, somewhat as in the Kinglets.]

THE MOUCHEROLLES (*Muscipeta*, Cuv.)—

Have a long beak, very much depressed, and twice as broad as high, even at the base; the ridge of the upper mandible very obtuse, but sometimes however the reverse; the edges slightly curved, the points and emargination feeble, and long vibrissæ at the gape.

Their weakness disables them from preying on aught but insects. All of them are foreign; and many are ornamented with long tail-feathers or with fine crests, or at least have vivid colours on the plumage.

[Several different natural groups are here brought together: the term is now generally restricted to some beautiful birds of the eastern hemisphere, the males of which have crimson and black plumage, and long even tails, the females being yellow where the male is red; their colours are distributed as in the Redstarts, and there are other birds of similar form and colouring, but stouter and larger, which compose the *Phenicornis*, Gould.]

Some species approximating the Moucherolles [or rather the Tyrants],—

THE FLATBILLS (*Platyrynchus*, Vieillot),—

Are remarkable for having the bill still broader and more depressed.

[They have been confused by many writers with the Todies, a widely separated genus, that does not even possess the distinctive characters of the *Passerinae*. They have also been ranged under many named minor subdivisions.]

Others, which have also the beak broad and depressed, are distinguished by their longer legs and short tail. They compose the genus

## CONOPOPHAGA, Vieillot,—

Of which but two or three species are known, all from America, that subsist on Ants, which has caused them to be ranged with the small tribe of Thrushes termed Antcatchers.

THE RESTRICTED FLYCATCHERS (*Muscicapa*, Cuv.)—

Have shorter bristles at the gape, and the bill more slender than in the Moucherolles. It is still, however, depressed, with an acute ridge above, a straight edge, and the point a little curved downward. [They are closely related by affinity to the Chats and Redstarts, as are also the Moucherolles, and have similar mottled nestling plumage, a character that does not occur in the great Tyrant group.]

Four species inhabit Europe, migrating southward in winter.]

The Grey Flycatcher (*M. grisola*, Gm.)—Grey above, whitish underneath, with some greyish streaks on the breast. [It is very common throughout Britain, seldom arriving before May: one of the least musical of our native Birds. Its legs are shorter than in the following, and general character different: hence, with some others from Africa, it composes the *Butalis* of Boié.]

The Collared Flycatcher (*M. albicollis*, Tem.), is very remarkable for the changes of plumage [or rather of colouring only] which the male undergoes seasonally. Resembling the other sex in winter, that is to say, grey [on the upper parts] with a white patch on the wing, it attains towards the nuptial season an agreeable distribution of pure black and white, the head, back, wings and tail, being of the former colour, and the forehead, a collar round the neck, a great patch on each wing, a smaller one in front of it, and the outer edge of the tail, white. It nestles in the trunks of trees.

Another species subject to the same changes has more recently been discovered, in which the neck of the male is black like the back in the nuptial season, and which wants the small white spot on the edge of the wing. It is the Pied Flycatcher (*M. luctuosa*, Tem.), which is found further northward than the other. [This species is remarkable for its local distribution in the British islands, being very common near the lakes of the north of England, and of rare occurrence elsewhere. It is doubtful whether the other ever occurs here. They are said to differ in their notes, and both lay blue eggs, whereas the Grey Flycatcher lays whitish eggs spotted with brown. The two pied species are also comparatively musical.]



The fourth was discovered in Germany, [in some parts of which it is common If is smaller than the others, with plumage resembling that of a Robin; constitutes the division *Erythrosteros* of Bonaparte].

The beak of the Flycatchers becomes more and more slender, till it finally approaches that of some Kinglets.

Some species, wherein the ridge of the upper mandible is more raised, and arched towards the tip, lead to the Chats and Wheatears. Certain of these appear to compose the *Drimophilus* of Temminck.

There are also several genera or subgenera closely allied to different links of the great series of Flycatchers, although they much surpass them in size. Such are

#### THE BALD TYRANTS (*Gymnocephalus*, Geof.).—

Which have nearly the same beak as the Tyrants, only that its ridge is rather more arcuated, and a great part of the face is destitute of feathers.

We know but of one species, from Cayenne, as large as a Crow, and the colour of Spanish snuff.

#### THE DRAGOON-BIRDS (*Cephalopterus*, Geof.).—

Have, on the contrary, the base of the bill adorned with feathers, which, radiating at top, form a large crest resembling a parasol.

Only one species is known, from the banks of the Amazon; of the size of a Jay, and black: the feathers on the lower part of its breast form a sort of pendent dewlap—(*C. ornata*, Geoff.; *Coracina cephaloptera*, Vieillot; *Cor. ornata*, Spix.)

#### THE COTINGAS (*Ampelis*, Lin.).—

Have the beak compressed, as in the generality of Flycatchers, but proportionally rather shorter, tolerably wide at base, and slightly arcuated.

Those in which it is strongest and most pointed, retain a very insectivorous regimen. They are named

#### PIAUHAUS (*Querula*, Vieillot).—

From their cry, and inhabit America, where they live in flocks in the woods, and pursue insects.

Such are the Common Piauhaus (*Muscic. rubicollis*, Gm.), black with a purple throat; and the Great Piauhaus, entirely purple, (*Cotinga rouge*, Vaillant; *Coracias militaris*, Shaw). The Grey Cotinga (*Amp. cinerea*) resembles the Piauhaus rather than the genuine Cotingas. The Golden-throated Piauhaus (*Coracias scutata*, Lath., or *Coracina scutata*, Tem.), has a smaller beak, and approximates the Bald Tyrant.

#### THE RESTRICTED COTINGAS (*Ampelis*, Vieillot).—

In which the beak is rather weaker, feed on berries and soft fruits, in addition to insects. They inhabit humid places in South America; and the greater number are remarkable, at the breeding season, for the splendour of the azure and purple which adorn the males. During the rest of the year both sexes are grey or brown.

The Scarlet Cotinga (*A. carnifex*, Lin.).—Crown, rump, and belly scarlet; the rest brownish-red: fourth quill of the wing narrowed, shortened, and tough or horn-like. The Pompador Cotinga (*A. pompadora*, Lin.).—Of a lovely reddish purple, with white quill-feathers. The Blue Cotinga (*A. cotinga*, Lin.).—Splendid ultramarine, with a violet breast, frequently traversed by a large blue band, and spotted with dark yellow. There are others equally handsome.

#### THE TERSINES (*Tersina*, Vieillot).—

Are Cotingas with the beak wider at its base. As

The Tersine of Buffon (*Amp. tersa*, Gm.; *Procyias tersina*, Tem., or *Pr. hirundinacea*, Swainson).

#### THE CATERPILLAR-HUNTERS (*Ceblerpyris*, Cuv.; *Campophaga*, Vieillot).—

With the beak of the Cotingas, have a singular character, which consists in the somewhat prolonged, stiff, and spiny shafts of their rump-feathers. They inhabit Africa and India, and feed upon Caterpillars, which they find on the highest trees; but they have none of the brilliancy of the Cotingas. Their tail, somewhat forked in the middle, is rounded at the sides.

Such are the Grey and Black Caterpillar-hunters of Vaillant (the former of which is the *Muscic. cana*, Gm.). The Yellow C. of the same naturalist is the young of *Turdus phoenicopterus*, Tem. Add *C. ambriatus*, Tem. Col. 249, 250.

We may also distinguish

#### THE WAXWINGS (*Bombycilla*, Brisson).—

The head of which is adorned with [erectible] feathers, longer than the rest, and they have besides

a singular character in the secondary quills of the wing, the ends of which [at least in two of the three species, are converted into] smooth, oval, red disks, [much resembling red sealing-wax].

There is one in Europe, the Common Waxwing (*Amp. garrulus*, Lin.), [and which also occurs in America westward of the Rocky Mountains, and in Asia to China and Japan.] It is less than a Thrush, with soft vinous-grey plumage, the throat black; tail black, tipped with yellow, [with minute scarlet lobes resembling those on the wing-secondaries in old specimens\*, wherein the primary quills also are each terminated with white, forming a series of transverse markings]; wings black, variegated with white [and yellow]. This bird appears in flocks, at long intervals, and without regularity, from which circumstance its presence was long considered an evil omen. It is not timorous, is easily captured and kept in captivity, eats of every thing, and a great quantity, [but in the wild state is principally baccivorous, and in times of necessity has been seen to eat the buds and sprouts of various trees: it flies rapidly, and has a low warbling song]. This bird is supposed to breed very far to the north. Its flesh is esteemed good eating.

There is a very similar but smaller species in America (*Amp. garrulus*, B., Lin.; *A. americana*, Wils.; *B. carolinensis*, Brisson; *B. cedrorum*, Vieillot), [the Cedar-bird of the Anglo-Americans: it inhabits eastward only of the Rocky Mountains.]

A third, in Japan (*B. phænicoptera*, Tem.), has no wax-like appendages to the wings, and the tail and lesser wing-coverts are tipped with red. [Its size equals that of the first.]

M. M. Hofmansegg and Illiger have separated, with equal propriety,—

THE CAMPANERO and some others (*Procnias*, Hof.),—

Wherein the beak, weaker and more depressed, opens nearly as far as the eye. They are indigenous to South America, and subsist on insects.

They require to be subdivided into

THE CAMPANEROS (*Procnias*, as restricted),—

Which have feathered throats.

One species (*Amp. carunculata*, Gm.), distinguished by a long soft caruncle at the base of its beak, is white when adult, greenish when young. [This is the celebrated Campanero or Bell-bird of Guiana, the loud sonorous voice of which, heard from time in the depths of the forest, during the stillness of mid-day, exactly resembles the tolling of a bell.]

Others,

THE AVERANOS (*Casuarhynchus*, Tem.),—

Have naked throats.

There is one in which the naked part of the throat of the male is covered with fleshy caruncles: the Averano of Buffon (*Amp. variegata*, Lin.). Another (*Procn. araponga*, Fr. Max; *Casm. carunculatus*, Spix) has some small thinly-scattered feathers on the same place. These birds also are white in the adult state, and have the females and young greenish.

Finally, we place at the end of the Cotinga group,

THE GYMNODES (*Gymnoderes*, Geoff.),—

The beak of which is only a little stouter, but the neck is partly naked, and the head covered with velvety feathers.

The species known is from South America, and in great part frugivorous. It is the size of a Pigeon, and black, with bluish wings. (The *Gracula nudicollis*, Sh.; *Corvus nudus* and *Gracula fetida*, Gm.).—N.B. M. Vieillot brings the Choucaris, Gymnode, and Dragoon-bird together, to form his genus *Coracina*.

THE DRONGOS (*Edolius*, Cuv.; *Dicrurus*, Vieillot)—

Also pertain to the great series of Flycatchers. Their beak is equally emarginated and depressed, its upper ridge acute; but they are distinguished by having both mandibles slightly arcuated throughout their length: the nostrils are covered with feathers, besides which there are long hairs forming moustaches. [These interesting birds exhibit a flycatching modification of the great corvine type].

The species are numerous in the countries bordering the Indian Ocean, and are generally glossy black, with a forked tail, [the outermost feathers of which are often extremely long, with a naked shaft except at the base and tip: they are gregarious, assembling towards the evening, and subsist on insects, particularly Bees and Wasps, for which they hawk in the vicinity of the hive; are popularly termed Devil-birds]. It is said that some of them sing as finely as a Nightingale.

The genus *Sparactes* of Illiger was founded on a disguised specimen of one of these birds, decorated with feathers not its own by a dealer, and the legs of a Hoopoe.

\* This tends to corroborate a remark in p. 156, wherein the tail-feathers are stated to correspond to the wing-secondaries, excepting the middle pair, or uropygials, which represent the wing-tertiaries.—Ed.

### THE PHIBALURES (*Phibalura*, Vieillot).—

Have an arcuated ridge to the bill, as in the Drongos, but the beak is shorter than the head.

The only known species (*Ph. flavirostris*, Vieillot) inhabits Brazil, and has a deeply-forked tail; its plumage is spotted with black and yellow, and there are some red feathers on the head, which recall to mind the Tyrant Flycatchers. [This is a very curious species, which is closely related to the Swallows, as well as the Cotinga group, and to the Tyrants.]

### THE TANAGERS (*Tanagra*, Lin.).—

Have a conical beak, triangular at its base; the upper mandible emarginated towards the tip, with its ridge arcuated; wings and flight short. They resemble the Sparrow tribe in their habits, and feed on grain as well as on insects and berries. The greater number are conspicuous in our collections for their brilliant colours. [All are peculiar to America.] We subdivide them as follow:—

### THE LINDOS (*Euphonia*, Vieillot?).—

Or *Bullfinch Tanagers*, which have a short beak when viewed vertically, bulging on each side of its base: their tail is proportionally shorter than in the others.

Such are the *Tanagra violacea*, *cayennensis*, *diademata*, *viridis*, *chrysogaster* [and several others. The Spanish name *Lindo*, applied by Azara, intimates their brilliancy].

### THE FINCH-TANAGERS (*Habia*, Vieillot).—

Have a thick, bulging, conical bill, as broad as high, the upper mandible of which is rounded above.

Such are *Tan. flammeiceps*, Pr. Max., *T. superciliosa*, *psittacina*, and *atricollis*, Spix, &c.

### THE TANAGERS, properly so called,—

Have a conical beak, shorter than the head, as broad as high, the upper mandible arcuated and slightly pointed.

*T. episcopus*, *multicolor*, and numerous others [many of them remarkable for the variety of contrasting, brilliant hues, which variegates and adorn their plumage].

*T. talas* and some others have been separated by Mr. Swainson under the name *Aglais*.

### THE ORIOLE-TANAGERS (*Tachyphonus*, Vieillot).—

Have the beak conical, arcuated, pointed, and notched towards the tip.

*T. cristata*, Tem., of which *T. brunnea*, Spix, is the young, and various others.

The *T. gularis* and *pileata*, Tem., and *T. speculifera*, Spix, approximate the *Bec-Ans* in the slenderness of their bills. "Mr. Swainson makes of them his genus *Spermagra*."

The *Pyranga* of Vieillot is founded on an individual deformity. We will designate his species *T. cyanicterus*.

In the *Palmiste*, Buff., the emargination of the upper mandible is very slight, and it almost entirely disappears in a proximate species, of which M. Vieillot has formed his genus *Icteria*. This bird is the *Pipra polyglotta*, Wilson, [a very curious species, the affinities of which are by no means obvious]. It conducts to the Weavers.

### THE CARDINAL-TANAGERS [*Pyranga*, as now generally accepted].—

Have a conical and slightly bulging beak, with an obtuse salient dentation on each side.

*T. miniastipennis*, Tem., or *T. castia*, Wils. Also *T. rubra* and *T. ludoviciana*, Wils., &c.

Lastly,

### THE RHAMPHOCLE-TANAGERS (*Jacapa*, Vieillot).—

Have a conical beak, the rami of the lower mandible of which are enlarged behind.

Such are *T. jacapa* and *brachia*, Tem., and *T. nigrogularis*, Spix.

[We may remark that the great group of Tanagers is simply a ramification of the Cotinga family, peculiar to the same restricted locality.]

### THE THRUSHES (*Thraus*, Lin.).—

Have the beak arcuated and compressed; but its point is not hooked, and the lateral emargination does not produce so marked a dentation as in the Shrikes. Nevertheless, as already stated, there are gradual transitions from one to the other of these genera.

The regimen of the Thrushes is more frugivorous: they feed much on berries, and their habits are solitary. [The majority are however gregarious during the winter; and some (as our common Fieldfare) even throughout the year.]

The name of Merle is applied to those species, the colours of which are uniform or distributed in large masses. [They are generally also more bulky; but pass, by insensible gradations, into the spotted-breasted Thrushes.]

The Black Merle, or *Blackbird* (*T. merula*, Lin.).—Male entirely black, with the bill and eyelids yellow; female blackish brown, reddish and more or less spotted on the breast, [beak seldom wholly yellow. The plumage is soft, and wings short and rounded]. A mistrustful species, which however is easily tamed, and sings finely, having even been taught to speak. [It is generally seen in pairs, and is at no season gregarious: appears to be peculiar to Europe, being replaced by an allied species (*T. psaliopterus*) eastward.]

The Ring Thrush (*T. torquatus*, Lin.).—Black, with the feathers bordered with whitish, and a conspicuous white gorget on the breast. [All the proportions of this bird exactly correspond, even to minutiae, with those of the Fieldfare, which is placed by many systematists in a different named division. The Ring Thrush inhabits bleak and upland moors, chiefly in the north of Europe, and migrates far southward at the close of autumn. It is a loud but inferior songster, and common only in a few districts of Britain.]

The lofty mountains of the south of Europe sustain two species (*T. saxatilis*, Lin., and *T. cyaneus*, Lin.). The first, which is more frequently seen northward, is better known. It sings finely, and nestles in steep rocks, or ruined buildings. [These Birds, which with various others constitute the *Petrocincla*, Vigors, and have since even been separated into minor groups, form a natural division apart from the other Thrushes, and are allied to the Chats and Wheatears, which they much resemble in habit. They are not found in Britain.]

The term Thrush is applied more particularly to the species with spotted plumage, that is to say, marked with black or brown spots on the breast. There are several in Europe, which assemble in large flocks in winter, and migrate southward.

The Mistle Thrush (*T. viscivorus*, Lin.).—Is the largest [with one exception] of the whole genus. [It is uniform yellowish-brown above, and tinged with sulphur-yellow on the under parts, which are speckled with transverse spots; beneath the wings white. Is common throughout Britain, and resident at all seasons; feeding principally on berries: the young alone associate in large flocks about October, which soon separate and disperse. This bird is very wild and distrustful, except at the season of propagation, when it affects the vicinity of human habitations, and is remarkable for the spirit with which it attacks and drives away Magpies, &c. from near its nest, uttering a loud rattling screech: it always builds on trees; and is a powerful but monotonous songster, heard nearly throughout the year.]

The Fieldfare Thrush (*T. pilaris*, Lin.).—Distinguished by the ash-colour of the neck and rump, [dark reddish colour of the back, &c. Is remarkable for generally nestling in society, being gregarious throughout the year; visits Britain in large flocks about November, and departs late in spring; is the least musical probably of the whole genus].

The Song or Mavis Thrush (*T. musicus*, Lin.).—[Brown above, yellowish on the breast, which is spotted with black; fulvous beneath the wings. It is the finest songster of the European species, and is seldom observed in flocks in Britain, where it is resident at all seasons. This bird is a great destroyer of snails.]

The Redwing Thrush (*T. iliacus*, Lin.).—Smaller than the preceding, the flanks and beneath the wings, deep rufous; [back brown, inclining to olive green; a conspicuous pale streak over the eye; and longitudinal markings on the under parts. This bird is a common winter visitant in Britain, arriving always some weeks before the Fieldfare, and keeping in more straggling flocks, the individuals of which depart gradually in spring, and not simultaneously, as in that species. It is an inferior songster.]

Allied to the Fieldfare, Redwing, and Ring Thrushes, are numerous foreign species, two of which—of intermediate character to those mentioned—occur in Eastern Europe, *T. Naumanni* and *T. atrogularis*; others, related to the Redwing and Mavis, all of which are proper to the eastern parts of Asia, including Japan, have slaty-black plumage, more or less relieved, to which group the *T. sibiricus*, which has also been met with in the east of Europe, appertains. There are foreign species of this extensive genus intermediate, in every possible way, to all those of Europe: some are found almost everywhere.

In a group inhabiting Australia, the Indian Archipelago, and slopes of the Asiatic mountains, the dorsal plumage is mottled at all ages; a character peculiar to the nestling dress of the others. One species belonging to it (*T. Whitii*, Eyton), the largest of all the Thrushes, resembles the Mistle Thrush in its form and proportions, and occasionally strays to the west of Europe, having been met with even in Britain: it is common on the southern slopes of the Himalayas. Another (*T. varius*, Horaf.) indigenous to Java, conducts to the *Ianthocincla*, not only by this style of marking, but by its soft puffy plumage, short and rounded wings, and large bill and feet.

Other Thrushes, peculiar to America, and breeding in the northern division of that continent, are solitary in habit, and pass insensibly into the Nightingales; successively diminishing in size; having the bill gradually weaker and tarsi more elongated; assuming even the russet tint and rufous tail of those birds, gradually losing the breast-spots, &c. Such are *T. mustelinus*, Gm., which differs little from the true Thrushes, *T. solitarius*, *Wilsonii*, and *minor*, which last is but arbitrarily separable from the European Nightingales.

A group now generally distinguished is that of

#### THE MOCKERS (*Mimus*, Boié; *Orpheus*, Swains).—

Wherein the form is much more elongated, the wings shorter, and tail in particular longer, and the upper mandible more curved.

The Mocking-bird of North America (*Turdus polyglottus*, Lin.).—One of the finest of song-birds, and remarkable for its great facility of imitating almost any sound.

There are several others, all of them peculiar to America.

The Thrushes form a great centre of radiation, which ramifies in every direction, and graduates till the normal

generic features disappear. We have already seen them pass through *Petrocincla*, into the Chats and Wheatears, to which should be added the Robins, Redstarts, Phenicorns, &c.; through *T. varius*, into the *Ianthocincla*, Gould, an eastern group, with large bill and feet, very soft plumage, and short wings, the species of which inhabit shrubberies, and find their food chiefly on the ground, never flying to any distance; through certain North American species into the Nightingales; and the passage into various other received genera is equally gradual: in a word, these latter are merely ramifications of *Turdus*, different as some of them appear in extreme cases. Thus *Cinclusoma*, Vigors, conducts from the Fieldfare to the subdivision *Accentor*; the Dippers and Ant-catchers to the Wrens and Tree-creepers, &c. &c.]

Some of these birds appear to approximate the Shrikes in their habits, although there is nothing in the form of the beak to distinguish them from other Thrushes.

There are even no available characters by which to distinguish certain African species, which live in numerous bustling troops, like Starlings, pursue insects, and commit great havoc in gardens.

Several of them are remarkable for the glossy tints of their plumage, which are of a browned steel-colour, (as *T. auratus* and *T. nitens*, Tem.); and one of the former for its cuneated tail, which is a third longer than the body (*T. aeneus*, Tem.) [The straightness of the wing indicates these birds to belong rather to the Starling group, as does also their brown and spotless nestling plumage, the wing primaries of which are shed at the first moult, which is not the case in any of the Thrush tribe. Their habits, as already mentioned, are strictly those of the Starlings.]

We conceive it proper to approximate also the New Guinea Thrush, with a tail three times longer than the body, and a double crest on the head, which has been considered a Bird of Paradise (*Paradisaea gularis*, Latham, and *P. nigra*, Gm.), but only on account of the incomparable magnificence of its plumage. M. Vieillot applies to it the generic name *Astrapia*.

Other Thrushes with brilliantly shining plumage, the occipital feathers of which are pointed as in the Starlings, compose the *Lamprolornis* of Temminck. [These also strictly pertain to the natural family of Starlings.] We should distinguish the *L. erythrophrys*, on account of its bright red eyebrows, formed of cartilaginous feathers.

Some Thrushes have the bill so slender, that it approximates that of the Wheatears (the *Ixos* of Temminck). [These birds are mostly crested, and have bright red feathers under the tail, which generally intimates that that appendage is carried erect. They rank among the very finest of singing birds, and the celebrated *Buhl-buhl* of the Oriental poets is one of them: all are peculiar to the eastern hemisphere, and they are closely related to the Philodons, into which they pass by insensible gradations.]

Others have a slender bill, but straight and strong, and in the greater number of them the tail is excessively forked. They are the *Enicures* (*Enicura*, Tem.), [a group having much the appearance, at first sight, of the Pied Wagtails, and resembling them in habit, but which are essentially modified Thrushes, and not distantly removed from the Wheatears].

Others, again, [closely allied to the last,] are distinguished by having legs so long, that they have the general appearance of *Waders*. They constitute the *Grallina* of Vieillot, or *Tanypus* of Ope!

#### THE CRINONS (*Criniger*, Tem.)—

Are Thrushes with strong setæ at the gape, and which have sometimes bristly feathers on the neck.

Such is *Cr. barbatus*, Tem. (Col. 88).

#### THE ANT-CATCHERS (*Myothera*, Illig.)—

Are known by their lengthened limbs and short tail. They subsist on insects, and principally Ants: inhabit both continents.

Those of the eastern hemisphere, however, are remarkable for their brilliant colours. They are

#### THE BREVES of Buffon (*Pitta*, Vieillot),—

[The plumage of which recalls to mind that of the Halcyons and Kingfishers, the latter of which they further resemble in their flight, as do also the Dippers and Wrens, and they similarly frequent streams and brooks, like the Dipper of Europe.]

Such are *Cornus brachyurus*, Gm., and several other beautiful species, to which we add the *Turdus cyanurus*, Latham, or *Cornus cyanurus*, Shaw, which only differs in the tail, which is rather more pointed. [There are indeed two natural subdivisions, distinguished apart by the form and structure of the tail].

The *Pitta thoracina*, Tem., of which MM. Vigors and Horsfield make their genus *Thimalla*, is but little removed from *P. cyanura*, Vieillot, if we except its sombre hues and its beak, which latter diminishes more regularly in front, and thereby approaches the Tanagers.

Those of the New Continent, which are much more numerous, have brown tints, and vary in the length and stoutness of the bill. They obtain their living from the enormous Ant-hills which abound in the woods and deserts of South America; and the females of them are larger than the males. These birds fly but little, and have sonorous voices, even extraordinarily so in some instances. [They are essentially gigantic Wrens.]

Among those which have a thick and arched bill, may be particularized

The King of the Antcatchers (*Turdus rex*, Gm.; *Corvus grallarius*, Shaw), which is larger than the others, also the highest upon its legs, and that which has the shortest tail: at the first glance it might be taken for a wader; its size is that of a Quail, and its grey plumage is elegantly barred across. This species lives more isolated than the others. M. Vieillot has formed of it his genus *Grallaria*.

The species with a straighter, but still tolerably strong beak, approximate the Bush-Shrikes with similar bills.

Such are *Thamnophilus stellaris* and *Th. myotherinus*, Spix, with various others. The *M. leucophrys*, Tem., although from Java, seems to approach this group; as does also the *Brachypteryx montana*, Horsf., from the same country, in the length of its limbs; but its tail is longer in proportion, and beak more like that of a Wheatear.

Others have a sharp and slender bill, which, together with their barred tail, allies them to the Wrens.

Such are *Turdus bambla*, Tem., and *T. cantans*, Tem. Here should come M. Vieillot's genus *Rhamphococcyz*.

We should replace among the Thrushes, however, numerous species that have been ranged with the Antcatchers. No group has been more overloaded with species that do not belong to it. At the same time, we must confess that the present is not more rigorously defined than other divisions of the *Dentirostre*.

We may approximate to the Antcatchers

#### THE ORTHONETS (*Orthonyx*, Tem.),—

Which have the beak of the Thrushes, but shorter and more slender; their legs are long, the claws almost straight, and the tail-feathers terminate in a stiff point, as in the Tree-creepers.

[The fact is, that the Antcatchers, Dippers, Wrens, Tree-creepers, and various other named subdivisions, are merely modifications of the same ramus of the great Thrush group, which grade insensibly into each other in every possible way.]

We should also separate from the Thrushes

#### THE DIPPERS (*Cinclus*, Bechstein; *Hydrobata*, Vieillot),—

Wherein the beak is compressed and straight, with both mandibles of an equal height, nearly linear, and tapering towards the point, the upper but slightly arcuated.

One inhabits Europe, the White-breasted Dipper (*Sturnus cinclus*, Linn.: *Turdus cinclus*, Lath.), which stands rather high, and has a moderately short tail, therein approximating the Antcatchers. It is [blackish] brown, with white throat and breast, and remarkable for its singular habit of immersing its whole body without swimming, but walking about [in a jerking, fluttering manner] at the bottom of streams, in search of the small animals which constitute its food. [At least two others have been ascertained, *C. pallasi*, from Asia generally, and *C. americana*: all of them frequent mountain torrents, and our native species generally builds its domed nest in the precipice behind a water-fall, through which it plunges to and fro; its actions are very similar to those of a Wren.]

Africa, and the countries bordering on the Indian Ocean, supply a genus of Birds related to the Thrushes, which I have named

#### PHILEDONS (*Philedon*, Cuv., comprising *Meliphaga*, Lewin),—

The beak of which is compressed, slightly arcuated throughout its length, and emarginated towards the tip; their nostrils are larger, and covered by a cartilaginous scale, and their tongue terminated with a pencil of hairs.

The species, generally remarkable for some peculiarity of conformation, have been distributed by authors in the most various genera. [Their manners and actions, as observed in captivity, bear an exceedingly close resemblance to those of the Starlings.] Some of them have fleshy caruncles at the base of the beak: as *Certhia carunculata*, Lath., which inhabits the Friendly Isles, and is stated to be a superb songster, with various others. These constitute the *Oreadon* of Vieillot, "and certain of them the *Anthoekera*, Swainson."

Others have portions of skin about the cheeks, divested of feathers, as the *Merops phrygius* of Shaw, &c.

In those even, which are every where completely feathered, some peculiar disposition of the plumage may be observed: as in the *Merops Nova Hollandia* of Brown, wherein the ear-feathers become frizzled, and descend almost to the fore-part of the breast.

Others again are destitute of any singularity. "Those species in which the bill is long and slender, as *Certhia oucellata*, Vieillot, compose the *Mysomela*, Swainson."

#### THE MINAS (*Eulabee*, Cuv.),—

Approximate the Philedons. Their beak is nearly that of a Thrush; their nostrils round and smooth; and they are particularly distinguished by the broad strips of naked skin on each side of the occiput and below the cheek.

Linnæus confounded two species under the name of *Gracula religiosa*. That of India (*G. indica*), is the size of a Blackbird, and glossy black, with a white spot near the base of the wing-primaries. Its feet, bill, and the naked parts of its face are yellow. The Javanese species (*G. javanica*) has a broader bill, more deeply cleft, also more hooked at the end, and without emargination: consequently, it should come after *Colaria*, Cuv. [a genus

the entire anatomy of which is widely different]; but it resembles the other in all the rest of its conformation, and particularly by its naked spaces on the sides of the head. Of all birds, this one is said to imitate most completely the language of Man.

Nothing can be more perplexing to systematists than the diversity in the form of bill observable in birds otherwise so nearly allied. [It intimates, with a variety of other circumstances, that naturalists have attached undue importance to the character thence derivable, in tracing the affinities of these animals. The fact is, that the *Passerines* contain two principal centres of radiation,—the genera *Turdus* and *Corvus*,—together with several of subordinate importance, each of which may exhibit modifications suited for any mode of life, as *fly-catching*, *nectar-sucking*, &c.: those species analogously modified upon different of these types, however, having no immediate physiological relationship for each other, such as is evinced by genera really connected by affinity, however differently modified, in their changes of plumage, system of coloration, eggs, &c., all of which require to be taken much more into consideration than has hitherto been the practice, if these birds are to be classified in accordance with their true natural affinities. One great help to a sound arrangement is afforded by the geographical distribution of forms; another by the nestling plumage, as stated on a former occasion; and a third, judiciously and not inconsiderately followed, by the style and character of the colouring and structure of the feathers, which are worthy of particular attention. Habit is the most deceptive guide of any, but should nevertheless be duly kept in view].

#### THE GRACKLES (*Graculus*, Cuv.; *Cridotheres*, Vieillot)—

Constitute another genus allied to the Thrushes [or rather to the Starlings], the species of which inhabit Africa and the countries bordering on the Indian Ocean. Their beak is compressed, very slightly arcuated and notched, its commissure forming an angle as in the Starlings. The feathers on the head are nearly always narrow, and there is a naked space round the eye. Their habits are those of the Starlings, like which they fly in large flocks, and pursue insects.

One species appears occasionally in Europe, the Rose Ouzel (*Pastor roseus*, Meyer), [which is sufficiently distinct from the true Grackles]. It is of a shining black, with the back, rump, scapulars, and under-parts, rose-coloured; the coronal feathers narrow, and lengthened into a pendent crest. This bird is of great service in warm countries, by destroying Grasshoppers.

Another species, *Paradisæus tristis*, Gm., has become celebrated for similar services rendered to the Isle of France. It is however a very general feeder, nestles in palm-trees, and is extremely docile. Its size is that of a Blackbird, and colour brown, blackish on the head; a spot near the tip of the wing, lower part of the abdomen, and tips of the lateral tail-feathers, white. There are numerous others. Linneus and his followers brought together most discordant species under the appellation *Gracula*.

#### THE MANORRHINES (*Manorrhinus*, Vieillot)—

Have the beak very much compressed, only slightly arcuated, and feebly notched; the nostrils large, but in great part closed by a membrane, which leaves only a narrow slit; neck short. The frontal feathers, which are soft like those of young birds, are partly reflected over the nostrils.

*M. viridis*, Vieillot, Gal. 149.

#### THE CHOCARDS (*Pyrrhocorax*, Cuv.)—

Have the compressed, arched, and emarginated bill of the Thrushes, but their nostrils are covered by incumbent feathers, as in the Crows, from which they were long undistinguished.

We have one the size of a Daw, the Alpine Chocard (*Corvus pyrrhocorax*, Lin.), entirely black, with a yellow bill, the feet brown at first, then yellow, and finally red, which nestles in the clefts of rocks in the highest mountains, whence, in winter, it descends in great flocks into the valleys. It feeds on insects, snails, and likewise on fruit and grain, and does not reject carrion: [is simply a modified Crow, nearly allied to the Choughs].

Another, in India (*Pyr. hexanemus*, Cuv.), is distinguished by three barbless shafts, as long as the body, which grow on each side among the feathers which cover the ear.

I can find no sufficient character by which to separate from the Thrush group

#### THE ORIOLES (*Oriolus*, Lin.),—

Wherein the beak, otherwise resembling that of the Thrushes, is merely a little stouter, the legs also being rather shorter, and the wings proportionally longer. Linneus and several of his successors confounded them with the Cassicans, which they merely resemble in colour.

The European Oriole (*O. galbula*, Lin.), is somewhat larger than a Blackbird. The male is of a bright yellow, with the wings, tail, and a spot behind each eye, black, the tip of the tail yellow; but during the two first years he retains the permanent colouring of the female, wherein the yellow is replaced by olive-green, and the black by brown. This bird suspends its skilfully-constructed nest to the branches of trees, feeds on cherries and other fruit, and during spring on insects. It is timorous, remains in France only for a short time in summer, and travels in pairs, or three together. [In accordance with its migratory habits, it has longer wings than any of its numerous congeners.]



We should distinguish from among the others the *Regent Oriole* of authors (*Sericulus regens*, Lesson), the plumage of which is fine silky black, with velvety feathers of a bright orange-yellow on the head and neck, and a great spot of the same colour on each wing. [The female is brown, spotted with dull white. *Paradisæus aures*, Shaw, should range along with it.]

#### THE GOULINS (*Gymnops*, Cuv.)—

Have the same strong beak as the Orioles, the nostrils rounded and scaleless, and not surrounded by any membrane, and a great part of the head naked of feathers.

The Grey Goulin (*Gracula calva*, Gm.), &c.—Some of them have prominences on the beak, as the *Corbicalao* of Vaillant (*Merops corniculatus*, Shaw): in these, "which constitute the *Tropidorynchus* of Swainson," the tongue is pencilled as in the Philodons.

#### THE LYRE-TAIL (*Mænura*, Shaw),—

The size of which has occasioned some authors to range it among the Poultry, pertains obviously to the order of *Passerinæ*, having the toes separated (excepting the outer and middle ones along the first phalanx), and approximating the Thrushes by the form of its beak, which is triangular at base, elongated, a little compressed, and notched towards the tip; the nostrils being large and membranous, and in part covered by reflected feathers, as in the Jays. The great tail of the male is remarkable for the three sorts of feathers which compose it; namely, the twelve ordinary, with very fine and widely separated barbs, two medial, each garnished on one side only with a vane, and two exterior, curved like the letter S, or like the frame of a lyre, the internal barbs of which, large and serrated, resemble a broad riband, whereas the external are very short, lengthening only towards the tip. The female has only twelve tail-feathers of the ordinary structure.

This singular species (*M. lyra*, Auct.) inhabits the rocky districts of New Holland; its size is somewhat less than that of a Pheasant. [It frequents the most retired parts of the country, and runs very fast upon the ground, but its cumbersome tail is said to disable it from flying in a direct line. The order of Birds to which it strictly belongs is sufficiently indicated by its being a songster. They are said to sing for a couple of hours in the morning, beginning when they quit the valleys, till they attain the summit of a hill, where they scrape together a small hillock, as they exhume the grubs on which they feed: on this they afterwards stand, with the tail spread over them; and in this situation imitate the notes of every bird within hearing, till after a while they return to the low grounds.]

#### THE SLENDER-BILLED PASSERINÆ (*Motacilla*, Lin.)—

Compose an excessively numerous family, characterized by the beak, which is straight, slender, and awl-shaped. When slightly depressed at the base, it approaches that of the Flycatchers; and when compressed and a little curved at the point, that of the straight-billed Shrikes. Some endeavour has been made to divide them as follows.

#### THE CHATS (*Saxicola*, Bechst.)—

Have the beak a little depressed and rather wide at base, which allies them to the last small tribe of Flycatchers. They are lively birds, rather high upon the legs. The European species build on or near the ground, and subsist on insects. [They grade from the Rock-thrushes (*Petrocincla*), and like them are remarkable for always perching on the summits of objects.

Three inhabit the British isles.]

The Stone Chat (*Mot. rubicola*, Lin.).—A small bird, [with a short tail; black on the upper parts and throat in summer, with a dark reddish breast, some white on the sides of the neck, wings, and tail; the female browner: in winter the black is more or less concealed by brown margins to the feathers; and the young are at first speckled with whitish. This species is resident throughout the year in Britain, and is common in furze-brakes and covert-less situations. It has little song, which, as in the following, is often delivered on the wing.

There are summer-visitants, of rare occurrence in the winter months.

The Whin Chat (*Mot. rubetra*, Lin.), resembles the last in form, and is more delicately coloured, with a conspicuous white streak over the eye, and black patch on the cheek. It also inhabits furze-brakes, and is more generally diffused in grassy places than the Stone Chat: is a monotonous songster.

The Wheatear Chat (*Mot. ananthe*, Lin.).—Larger than the preceding, with the crupper and basal half of the tail-feathers conspicuously white, the rest of the tail, wings chiefly, and a band through the eyes, black, and the body fulvous: the female is browner, and the young spotted with whitish. This species inhabits still more open situations, as chalk-downs and ploughed fields, and particularly the sea-shore. Its flesh is often eaten.

There are numerous others.]

THE ROBINS (*Sylvia*, Wolf and Meyer; *Ficedula*, Bechstein; [*Dandakus*, Boié; *Rubecula*, Brehm; *Erythacus*, Swains.])—

Have the beak merely a little narrower at the base than the preceding. They are solitary birds, which generally nestle in holes, and live on worms, insects, and berries.



The European Robin (*Mot. rubecula*, Lin.).—Olive-brown above, throat and breast orange-red, slightly bordered with ash-colour, the belly white; young mottled brown. [We have seen a very similar species, but with differently formed bill, from Trebizond; and there is another closely allied, from Japan.]

The Blue-throated Fantail (*Mot. suecica*, Lin.; [*Cyanocula suecica*, Brehm]).—Brown above, with a brilliant blue throat, in the middle of which is a rufous spot, [which disappears with age. This bird has been separated with propriety, and differs remarkably from the others in its gait, always running by alternate motion of the feet, like a Wagtail, instead of hopping; when running thus, it spreads out its tail from time to time like a fan. It is only an accidental visitant in Britain.]

The following are referrible to the *Raietilla*, Brehm; *Phaniscus*, Swains.]

The White-fronted Redstart (*Mot. phaniscus*, Lin.).—Grey above, with a black throat and white forehead, the under parts, rump, and all but the middle pair of tail-feathers, bright ferrugineous. [Female browner, with tail and rump similar to the male; young spotted. This is a common summer visitant in many parts of Britain, inhabiting the vicinity of large hollow trees, ivied ruins, dilapidated garden-walls, &c. Like most of the present group, it generally sings perched on some high pinnacle. Its note is plaintive and little varied.]

The Black Redstart (*Mot. erythacus*, *tithys*, *gibraltaricus*, and *atrata*, Gm.).—[Rather larger than the preceding, with longer wings: no red underneath, and rarely any trace of white on the forehead. It is more confined to rocky places and great buildings than the other, and is very rare in the British islands, where, however, it does not appear to be migratory. The young of this species are not mottled. It is an inferior songster.]

There are several others, all from the eastern hemisphere.

The *Petroica*, Swains., comprehends some nearly allied species from Australia. Others, with shorter legs, and rather stouter bills, conspicuous for the bright azure of their upper parts, compose the *Stalioa* of the same systematist, and are found only in America. These and many other named subdivisions, including the Phenocorns and Moucheroles, pass, however, in every possible way, into each other. They grade, as already noticed, from the *Petrocincla*; the true Robins form a closely-allied subdivision, *Geocincla* of Gould.]

#### THE FAUVETTES (*Curruca*, Bechst.).—

Have the bill straight, slender, and slightly compressed in front; the ridge of the upper mandible curving a little towards the tip.

The most celebrated bird of this subgenus [but which assuredly does not belong to it] is



Fig. 67.—The Nightingale.\*

The Nightingale (*Mot. luscinia*, Lin.), of a russet-brown above, whitish brown on the lower parts, with a rufous tint on the tail. Every one is acquainted with this songster of the night, the varied and melodious notes of which resound through the woods. It nestles upon trees, [always on or near the ground, among decayed leaves], and sings only till its young are excluded.

There is a rather larger species in the east of Europe, with obscure spots on the breast (*Mot. philomela*, Bechst.).—[These birds have no particular affinity with the following, but are essentially small slender Thrushes, almost inseparably allied to *Turdus minor* and some others from North America. They have much longer limbs than the Fauvettes, seek their food principally on the ground, among decaying leaves, and the young are in their first plumage mottled, as in the true Thrushes, which is not the case with the following. The Common or Plain-breasted Nightingale has very much the same manners as a Robin, and is equally pugnacious: we have known it

to breed in captivity with a female of that species. The Nightingales constitute the *Philomela*, Swains., *Luscinia*, Brehm.]

Other species, more particularly known as Fauvettes, have almost always an agreeable song, and sprightly habits. They are continually sitting about in pursuit of insects, nidificate in bushes, and the greater number of them frequent watery situations, among the reeds, &c. [Such as do so fall, for the most part, under the natural division *Silvicolae*, and are very distinct from the others: they have a peculiar babbling song, and are exclusively insectivorous.]

Some of them have proportionally large bills, and streakless plumage, dark above, paler underneath. Such are] The Great Babbler (*Turdus arundinaceus*, Lin.; *Sylvia turdoides*, Tem.).—Rather less than a Redwing, and

\* Sketched from life.

reddish-brown above, yellowish beneath, the throat white. [This species, which passes for a good songster, though extremely common on the opposite coast of Holland, has not yet been detected in the British islands. A nearly allied species (*S. olivetorum*, Strickland), which is rather smaller, is common in Syria. The rest are considerably less, and there is one of these, a miniature of *S. turdoides*, which is very common, though local, in South Britain, migrating in winter, as do all the rest: the *S. arundinacea*, Auct. They are the *Calamohorpe*, Meyer.

Other species have smaller bills, and are generally striated on the back, with longitudinal whitish streaks on the head, the *Calamodyta*, Bonap. Among them we find]

The Sedge Babbler (*Mot. salicaria*, Lin.; [*S. phragmitis*, Auct.]); distinguished by a conspicuous whitish streak over each eye. [This bird is also a common summer visitant in Britain, more generally distributed than the Reed Babbler (*S. arundinacea*); and is remarkable for the sparrow-like tone of many of its chirpings, which has induced an erroneous opinion that it is an imitator or mimic. There are several others.

Some species, not far removed from the Babblers, are remarkable for the absence of bristles at the gape (which in the latter are rather conspicuous), for their graduated tail, composed of broad, soft feathers, their delicately-formed feet, with straight claws, and particularly for the singularity of their note, which consists of a prolonged sibilant trill, somewhat resembling that of the Mole-cricket. They compose the *Locustella* of Gould, of which three species inhabit Europe. Such, in Britain, is

Ray's Locustelle (*L. Raii*, Auct.), or the *Grasshopper Warbler* of many writers, (fig. 88), the dorsal plumage of



Fig. 88.—Ray's Locustella.

which is coloured like that of the Water Rail. It is common in many districts of this country, as a summer visitant, frequenting furze-brakes and other dense cover, where its singular voice is heard at all hours, but principally at dusk: while uttering this sound, it gapes very widely, and sometimes continues to emit it when flitting from bush to bush, or even hovering in the air. A larger species (*L. fluviatilis*), common on the reedy margins of the Danube, utters precisely the same sound. The *Sylvia certhiola*, Tem., of eastern Europe, constitutes the third.

Those which inhabit sylvan districts have, in general, stouter bills, and all feed more or less upon fruit, of which some are great devourers. They are very distinct from the foregoing, and several are delicate songsters. Such, in the British isles, are

The Blackcap Fauvet (*Curruca atricapilla*, Auct.)—Olive-brown above, ash-colour on the neck and lower parts, becoming whitish on the throat and belly; a black, or, in the female and young, reddish-brown cap on the head. One of the finest of our native vocalists, remarkable for the melody of the loud clear whistle with which it terminates its lays. It inhabits gardens and the outskirts of woods, arrives early in spring, and is very frugivorous.

The Garden Fauvet (*C. hortensis*) resembles the Blackcap in form, except that it is rather shorter; its head is of the same colour with the back, and there is a little grey on the sides of the neck. This species is remarkable for the deep mellow tones of its voice, arrives late in spring, and is similar in all its habits to the preceding.

The other British species have white on the exterior tail-feathers, and pertain to a group the members of which are mostly less arboreal, frequenting low bushes.

The White-breasted Fauvet (*C. garrula*), is, however, often heard from the summits of high trees, having nearly the same habits as the Blackcap. It is smaller than the preceding, with a proportionally more slender bill; and ashy-brown above, pure grey on the head and neck, silvery white below, the feet lead-coloured. Is common in gardens, and has a low warbling song, with a loud inharmonious finish.

The Whitethroat Fauvet (*C. cinerea*), is larger and browner than the last, with some mahogany-colour on the wings; feet yellowish. This species, exceedingly common about hedges and low brake, is seldom seen upon trees, and is an inferior chattering songster, that often ascends singing to a small height in the air, with peculiar gesticulations. Lastly,

The Long-tailed Fauvette (*C. provincialis*), made into a genus *Melospilus* by Leach, on account of its shorter wings and more graduated tail, wherein it only differs in a slight degree from some others, as *C. Sarda*, &c., is remarkable for being resident throughout the year in furze-brakes in some parts of the south of England. Its manners exactly resemble those of the Whitethroat. Colour dark ashy-brown, vinaceous-red below.

There are several continental species allied to all the above.]

Bechstein has separated from the Fauvettes

#### THE DUNNOCKS (*Accentor*, B.).—

The beak of which, still slender, but more exactly conical than that of other *Bec-fins* [and also rather sharply pointed], is slightly retracted at the edges. Their gizzard also is more fleshy.

The Alpine Dunnock (*Mot. alpina*, also *Sturnus alpinus* and *St. collaris*, Gm.).—An ashy-coloured bird [mixed with brown], with a white throat sprinkled with black, two ranges of white spots on the wing, and some bright rufous on the flanks. It inhabits the pastures of the high Alps, where it feeds on insects, descending however in winter into the plains to pick up grain. [A species of rare occurrence in the British islands.]

The Hedge Dunnock (*Mot. modularis*, Lin.), [currently termed the *Hedge Sparrow*.—This well-known species is resident in this country at all seasons, but the majority quit France in summer; emits a pleasing shrill song, particularly in early spring, which is accompanied by a peculiar shiver of the wings: it feeds very much on small seeds. There are a few others, of which one, *A. montinellus*, belongs to eastern Europe. The Dunnocks grade from the Thrushes through *Cinclosoma*.

with the Dutch one, but has probably slender-billed modifications of the same great type as the Tanagers.

### THE KINGLETS (*Regulus*, Cuv.)—

Have a slender bill, forming a perfect and very sharp cone, the sides of which even appear a little concave when viewed from above. They are small birds, which live among trees, and pursue Gnats.

Among European species, we have

The Golden-crowned Kinglet (*Mot. regulus*, Lin.),—which is the smallest of European birds, greenish-olive above, yellowish-white below, the head of the male marked with a brilliant golden-yellow crest, bordered with black, [which latter can open or close nearly over it: in the female the coronal feathers are pale yellow]. It constructs a globular nest on trees, with a lateral opening, suspends itself on their boughs in all positions, like a Tit, and approaches human habitations in the winter; [is very animated, and utters a shrill weak song in the breeding season].

A still smaller [or rather a somewhat larger] species has recently been distinguished, the crest of which inclines more to reddish, and which has a black streak before and behind the eye [with a white line on each side of the crest] (*Reg. ignipilus*, Naum). [This bird is of rare occurrence in the British isles, where the first is very common.]

A third has still more recently been detected in Dalmatia, and since in England, with only a pale central yellow line in place of the crest, but a bright yellow streak over each eye (*R. modestus*, Gould). This species wants a remarkable character of the others, which is, that the nostrils are covered by a single feather, that grows over them.

There are several more, allied to the two first, in Asia and America.

The following, however, ranged by the author in this genus, have little to do with them. They constitute the restricted *Sylvia* of some nomenclators, *Phylloscopus*, Meyer, and are all summer visitants only in these parts].

The Song Pettychaps (*Mot. trochilus*, Lin.) (fig. 89).—Rather larger than the Kinglets, and nearly of the same colour, but without any crest, [and also longer in its make. It is distinguished from one of the other British species by its duller tints, and a yellow tinge on the under tail-coverts, and from the other by its yellowish-brown legs. From both it differs in the pleasing melody of its song, which is extremely musical, though consisting only of a simple run of notes. This bird is extremely common throughout Europe, and we have seen a very similar species, if not actually identical, from Japan.]



Fig. 89.—Song Pettychaps.

The Dark-legged Pettychaps (*S. rufa*, Naum) (fig. 90), is rather smaller, half a shade darker, with shorter wings, and blackish-brown legs. Has only a monotonous cry of two notes, repeated many times successively, and occasionally alternated with a croaking sound, which is extremely peculiar. The young, after the first moult, of both this and the preceding species, are much brighter yellow

than the old birds, but their colour gradually fades during the winter.

The Grove Pettychaps (*Mot. sibilatrix*, Lin.) (fig. 91.) has longer wings than either of the preceding, more vividly green plumage on the upper parts, with a much broader and clearer yellow streak over the eye, yellow cheeks and breast, and pure white belly and under tail-coverts. It arrives later than the others, and frequents trees much more exclusively, where it may be recognized by its peculiar shivering voice, during the utterance of which it shakes its wings in a remarkable manner; it also emits a very plaintive cry, which is common to both sexes.

These birds generally nestle on the ground, among the herbage. There are two other European species, *Sylvia icterina* and *S. nattereri*.]



Fig. 91.—Grove Pettychaps

The European Wren (*Mot. troglodytes*, Lin.)—Brown and transversely striated, with rather a short tail, generally held erect. It builds a domed nest, and sings agreeably, even in the depth of winter.

[America produces numerous others, and there are even many well-marked divisions of them.] Some of the foreign species inosculate with the Antcatchers, and others with the Tree-creepers.

### THE WAGTAILS (*Motacilla*, Bechst.)—

Combine a bill even more slender than that of the Fauvettes, with a long tail, which they are constantly shaking up and down, lengthened legs, and particularly elongated tertiary feathers, which extend as far as the tip of the closed wing, imparting a resemblance to the generality of waders.



Fig. 90.—Dark-legged Pettychaps.

*Le Grand Pouillot* (*Motac. hippolais*, Lin.).—Larger than the preceding, [of the same size and shape as the Reed Babbler: it belongs, however, to a distinct group from either (the *Hippolais* of Brehm), and is a fine songster: it has never yet been detected in Britain, though common along the opposite coast].

### THE WRENS (*Troglodytes*, Cuv.)—

Merely differ in having the beak still more slender, and a little arcuated. [They are properly an American group, of which one species only occurs in the eastern hemisphere.]

That of France (*Mot. alba* and *chares*, Lin.), is grey above, white below, with the occiput, black. [The throat white in winter. It has not yet been registered as an inhabitant of Britain.]

The common British Wagtail (*M. Yarrowii*, Gould), appears to be of rare occurrence on the Continent or any. It is somewhat larger, and has a black back in summer.

Another species, common in the north of Britain, visits the southern counties in winter—the Yellow-rump Wagtail (*M. borealis*, Lin.).—It is grey above, with a very long tail, the outer feathers of which are white; unguis and rump bright citron-yellow, with a black throat in summer.]

Another in the south of Europe resembles the common French Wagtail when young, but acquires a black be with age, the *M. lugubris*, Roux. [It is larger than any of the others.]

#### THE FIELD-WAGTAILS (*Budytes*, Cuv.)—

With the general characters of the preceding, possess a long and almost straight hind-claw, which approximates them to the Pipits. [The tail is shorter, and style of colouring different.] They frequent pastures, and pursue insects among the cattle, [as do also the others].

The most common is the Grey-headed Field-Wagtail (*Mot. flava*, Lin.).—Bluish ash-colour on the head, olive on the back, bright yellow below, with an eye-streak and two-thirds of the lateral tail-feathers white. [It is very rare in Britain, where it is replaced by another species,

The *M. neglecta*, Gould, the head of which is yellow-olive, very bright in old males after the vernal moult, and the eye-streak intense yellow. It is much more seldom seen in watery situations than the preceding, and is rare on the Continent. The females of both are pale, or even dull white underneath, and the males in winter plumage have a reddish tinge on the lower parts, the young males not acquiring the yellow colour before the spring. Neither of them has any song, in which they differ from the Water-wagtails.

#### THE PIPITS (*Anthus*, Bechstein)—

Were long classed with the Larks on account of their long hind-claw, [and the resemblance of the colours, although not the texture, of their plumage], but their more slender and notched bill approximates them to the other *Bec-fins*.\* [They have absolutely the same form as the Field-wagtails, from which they differ only in their colours, and their habit of singing on the wing.]

Such as have a moderately curved hind-claw retain the faculty of perching. [The others do so, only rather less habitually.]

The Tree Pipit (*A. arboreus*, Bechst.).—Streaked olive-brown above, paler underneath, with longitudinal dark spots on the breast; two pale transversal bands on each wing. [A migratory species, and very sweet songster, of common occurrence in Britain. It generally rises singing from the ground, and after attaining a certain height, sails descending to the summit of a tree; then rises from the tree, and descends singing to the ground. Its carriage, and general character, as seen alive, are very different from those of the others.]

Others have the long hind-claw of the Larks, and keep more on the ground. As

The Common Pipit (*Alauda pratensis*, Gm.).—[More slender than the preceding, and nearly of the same colour in winter, but less fulvous or olivaceous in summer. It is extremely common throughout Europe, inhabiting mountain moors, and lowland heaths and marshes, even to the sea-side. Frequently ascends singing into the air, but less musically than the preceding.]

The Shore Pipit (*Anth. aquaticus*, Naum) is larger and darker-coloured, with a proportionally greater bill. This species abounds on the sea-coast, and is very rarely met with inland. Is a superior songster to the last.

The Great Pipit (*A. Richardi*, Vieillot).—An accidental straggler only in this country, but seldom met with. Is much larger than the others, and coloured like *A. pratensis*. There are several more, of which three inhabit Europe.

The Wagtails and Pipits compose a very insulated and distinct group, all the members of which are ambulatory in their mode of progression, and moult twice in the year. The young resemble or differ little from the adults, having a very dissimilar nestling dress from that of the Larks, to which they have been very generally, but erroneously, approximated].

We terminate this family of the *Dentirostres* with some birds which differ from all the foregoing, by having their two external toes connected as far as the second joint, a character wherein they resemble the family of *Syndactyli*.

#### THE MANAKINS (*Pipra*, Lin.)—

Have a compressed bill, higher than broad, emarginated, with great nasal fossae. Their tail and Manakins

\* The author erroneously states, in the original, that the form of the wing distinguishes them from the Wagtails.—Ed.

are short; and their general proportions occasioned them to be long regarded as allied to the Tits. At their head, but as a separate subdivision, should be placed

**THE ROCK-MANAKINS (*Rupicola*, Brisson).—**

Which are large birds, and have a double vertical crest on the head, composed of feathers disposed longitudinally like a fan.

The adult males of the two species, both from America (*Pip. rupicola*, Gm., and *P. peruviana*, Lath.),—are of a delicate rich orange colour; while the young are dull brown. They live on fruits, and scratch the ground like a common Fowl, construct their nests with wood in the depths of caverns, the female laying two eggs.

**THE EMERALD-MANAKINS (*Calyptomena*, Horsf.).—**

Merely differ from the preceding in the head-feathers not being disposed like a fan.

There is a species, not larger than a Thrush, in the Indian Archipelago, the colour of which is intensely brilliant emerald-green.

**THE TRUE MANAKINS (*Pipra*, Cuv.).—**

Are diminutive birds, generally remarkable for their vivid colours. They inhabit humid forests in large troops.

[All are American, and they obviously pertain to the great Cotinga family, as do also the Rock-manakins.]

**THE EURYLAIMES (*Eurylaimus*, Horsf.).—**

Have feet similar to those of the Manakins and Rock-manakins; but their beak, as strong as in the Tyrants, is exceedingly wide and depressed, its base being wider even than the forehead.

These birds inhabit the Indian Archipelago, and have a black ground-colour, relieved by vivid colours; they have much the air of the Barbets, a genus of a very different order. Frequent watery situations, and feed on insects [and also berries].

**THE FISSIROSTRES, —**

Compose a family numerically small, but very distinct from all others in the beak, which is short, broad, horizontally depressed, slightly hooked, unemarginated, and very deeply cleft, so that the opening of the mouth is extremely wide, and suited for swallowing insects, which are sought for on the wing.

The tribe of Flycatchers is that to which they are most nearly allied, and especially the genus *Procnias*, the beak of which only differs in its emargination.

Their regimen, exclusively insectivorous [in the generality of instances], renders them eminently birds of passage, which quit Europe in winter. They separate into diurnal and nocturnal, like the Birds of Prey.

**THE SWALLOWS (*Hirundo*, Lin.).—**

Are diurnal species remarkable for their close plumage, the extreme length of their wings, and rapidity of flight. We distinguish among them

**THE SWIFTS (*Cypselus*, Illiger).—**

Which, of all birds, have proportionally the longest wings, and fly with the greatest rapidity. [The Humming-birds will bear comparison, if not the pelagic Tachypete.] Their tail is forked, [and consists of ten feathers only]; their extremely short feet have a very peculiar character, the thumb being directed forward almost as much as the other toes, and the middle and outer toes having each but three phalanges, like the inner one.

The shortness of the humerus, the breadth of its apophyses, the oval fourchette [devoid of any medial appendage], the sternum (fig. 92), destitute of posterior emarginations,—indicate, even in the skeleton, their adaptation for vigorous flight; while the shortness of their feet, combined with the length of their wings, disables them from rising from a plane surface. Hence they pass their time

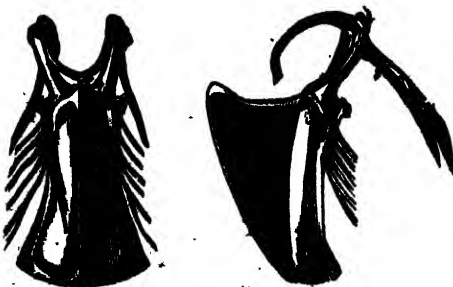


Fig. 92.—Sternum of Swift.

chiefly in the air, [even copulating on the wing], and pursue insects in flocks, sometimes at a great altitude, uttering discordant screams. They nestle in the holes of walls and rocks, and climb perpendicular surfaces with facility.

[With this genus, we enter upon a very different type of form from any of the foregoing. The entire anatomy, if we except the trachea and toes, and the latter more than any other genus, very closely resembles that of the Humming-birds. It is only in superficial or adaptive modifications that they accord with the Swallows. The lower larynx is furnished with only one pair of muscles, the ordinary *sterno-tracheales*; there are immense salivary glands, as in the Humming-birds, which secrete a viscid mucus, and no intestinal cæca; the clothing feathers have a considerable supplementary plume.

It is necessary to subdivide them into

THE TRUE SWIFTS (*Cypselus*, as restricted).—

Which have a forked tail, and feet as already described.

Of several species, two only inhabit Europe.]

The Common Swift (*Hirundo apus*, Lin.; *C. murarius*, Tem.).—Black, with a white throat, [and common throughout Europe in summer, making but a short stay. The young do not moult before the second autumn.]

The White-bellied Swift (*H. melba*, Lin.).—Larger, and brown, with white collar and medial inferior region. [Of rare occurrence in Britain. Unlike the Swallows, these birds rear but one brood in a season. There are several more.]

Others have stiff, pointed tail-feathers, as in the Woodpeckers, and the thumb directed backward; but they pass insensibly into the preceding. They constitute the

CHETURA, Swainson.

There is one common in North America, the *Chimney Swallow* of Wilson; also others in the eastern hemisphere, one or more of which inhabit Australia.

THE TRUE SWALLOWS (*Hirundo*, Cuv.).—

Have the feet and sternum similar to those of ordinary *Passerinæ*; [also the complex inferior larynx as usual, small cæca to the intestine, twelve tail-feathers, &c. Their rapid flight depends entirely on external modifications, for which reason it is much less capable of protraction than in the Swifts, as is particularly shown by their weariness after performing migration, on which occasions they have been seen to alight flat upon the sea.]

Some have the feet feathered to the claws, have a slight tendency to revert the posterior toe, and a moderately forked tail; as

The Martin Swallow (*H. urbica*, Lin.).—Glossy black above, white below and on the rump. Every one is acquainted with the solid mud-built nest of this species, fixed under window-caves, the jutting roofs of houses, &c.

Others have naked feet, and a more sharply forked tail, the exterior feathers of which are often much prolonged. As

The Chimney Swallow (*H. rustica*, Lin.).—Above [and across the breast] glossy black, the forehead and throat rufous, beneath [and a spot on each except the middle tail-feathers], white: it builds generally in chimneys.

The Bank Swallow (*H. riparia*, Lin.).—Brown above and across the breast, the throat and under-parts white. [A small tuft of down on each foot.] It burrows and forms its nest in steep banks. [There are two others in southern Europe, *H. rustula*, Tem., or *H. daurica*, Sav., and *H. rupestris*, Lin.]

Among the [very numerous] species foreign to Europe, may be noticed a very small one from the Indian Archipelago, the *H. ecuculenta*, Lin., which is brown above, whitish below and at the tip of its forked tail. It is celebrated for its nest, formed of a whitish gelatinous substance arranged in layers, and obtained by macerating [in the stomach] a peculiar species of fucus. The nutritious qualities attributed to these nests in China have rendered them an important article of traffic in that country.

[It is interesting to note that the Purple Swallow (*H. purpurea*) of America, which has a stouter beak than the others, feeds much on berries, at least while in its winter quarters, as observed by M. Audubon. The relation of this genus to the Phalacrocoracidae has been already remarked].

THE MOH-HUNTERS (*Caprimulgus*, Lin.).—

Have the same light, soft plumage, minutely mottled with grey and brown, that characterizes other night-birds. Their eyes are large; the beak, still more deeply cleft than in the Swallows, and [generally] armed with strong vibrissæ, is capable of engulfing the largest insects, which are retained by means of a glutinous saliva, [as in the Swifts]; the nostrils, placed at its base, are like small tubes; their wings are lengthened; the feet short, with plumed tarsi, and a membrane connecting the basal portion of the toes; the thumb itself is thus connected with the internal toe, and is directed

These birds bear the same relationship to the Swifts (not to the Swallows) that the Owls do to the Hawks, and have similar great eyes; also a simple vocal organ, and general anatomy very much resembling that of the Cuckoos, as will be partly seen by comparison of the figures we have given of the sternal apparatus of both. They have only ten tail-feathers; and the young are covered with down when first excluded.]

The common European species (*O. Europæa*, Lin.) [is remarkable for the loud sound it emits, like the burr of a spinning-wheel. Another, *O. rusticella*, Tem., visits south-western Europe. The former is the latest to arrive in spring of all our summer visitants, rarely appearing before the end of May.

Among the foreign species, a great number have longer tarsi, adapted for running on the ground. The tail varies much in shape, and there is one, from Africa, remarkable for a feather twice the length of the body, which arises from the carpus of each wing, and is barbed only at the end; another has prodigiously developed secondaries; and there are some with an appearance of sigrettes on the head, which constitute the *Lyncornis* of Gould.

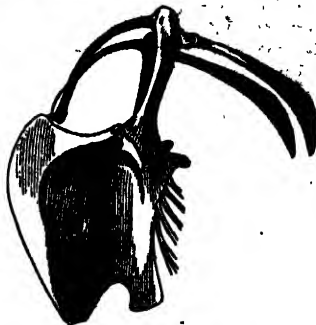


Fig. 63.—Sternum of Moth-hunter.

#### THE GUACHAROS (*Steatornis*, Humboldt)—

Have a stronger beak, and toes separate to their articulation, the thumb still directed inward.

These curious birds inhabit deep caverns in South America, subsist on berries, and the fat of the young is procured upon a large scale to be employed in cookery.

#### THE NYCTIBUNES (*Nyctibius*, Vieillot)—

Are also from South America, and are remarkable for having the shortest tarsi of any bird whatever: their wings are immensely long, and aides of the gape not bristled. "The toes are formed for clinging to the bark of trees, as their proportions completely disqualify them from rising from a level surface.

There are several large species, which ordinarily float at a great altitude above the forests.

#### THE EGOTHELES (*Egotheles*, Vig.)—

Have long tarsi, and toes apparently fitted for hepping from bough to bough; the wings comparatively short.

The only known species inhabits Australia, and is the *Caprimulgus Novæ Hollandiæ* of Phillips].

#### THE PODARGUES (*Podargus*, Cuv.)—

Have the form, colour, and habits of the Moth-hunters, but the bill is considerably more robust, and there are no membranes to the toes, nor pectination of the middle claw, [a character which is wanting in several even of the true Moth-hunters].

The species inhabit Australia and Australasia, and have some appearance of sigrettes on the head: are remarkable for the singularity of their general aspect.

The foregoing genera, commencing with the Moth-hunters, form an entirely distinct natural group, intermediate to the Swifts and Cuckoos, but passing into neither.]

The third family of the Passerines, or

#### THE CONIROSTRES,—

Is composed of genera that have a stout beak, more or less conical, and [generally] devoid of emargination. They subsist more exclusively on grain as the beak is stronger and thicker.

We first distinguish among them

#### THE LARKS (*Alauda*, Lin.)—

Which have a long and straight hind-claw, a character which however is also more or less marked in the Pipits, and in the Snowflecks, yet to be denoted. They are granivorous birds, and pulverators for



The Wood Lark (*A. arvensis*, Lin.).—Similar in size and plumage, with longer carpal feathers, and of less common occurrence than the preceding. It approaches villages, (and habitually seeks its food on the high road, and is remarkable for never visiting this country, though not rare on the opposite coast, even in the vicinity of Calais.

The Wood Lark (*A. arvensis*, Lin.).—Less, with a shorter tail, and the crest rather less elongated; a pale streak is continued round the occiput. [This delightful vocalist, which particularly frequents woodland hilly districts is remarkable for the delicacy of its tones, which are peculiarly soft and plaintive.

Nine others are found in Europe, either occasionally or habitually; of which one only—the Shore Lark (*A. alpestris*), a northern species, occurs as a very rare straggler in Britain. Several have much stouter bills than the foregoing; and three or four, including *A. alpestris*, a pair of aigrettes, or pointed tufts of feathers, on the head.

The Larks, which have been much subdivided by systematists, compose a very isolated family, well characterized by their peculiar nesting plumage, which is entirely shed (including all the primaries) before the first winter. With the exception of one species, they are peculiar to the eastern hemisphere. Several have the beak comparatively stout and thick.]

#### THE TITS (*Parus*, Lin.).—

Have the beak slender, [rather] short, straight and conical, with little hairs at its base, and nostrils concealed by the plumage. They are very active little birds, continually flitting from spray to spray, and suspending themselves in all kinds of attitudes, rending apart the seeds on which they feed, [which they hold firm with the foot while piercing a small hole in the husk, through which they extract the kernel], devouring insects whenever they see them, and not even sparing small birds when they happen to find them sick and are able to destroy them. They store up provisions of grain; nidificate in the holes of trees, and produce more eggs than the generality of *Passerine*.

[These little birds are miniatures of the Jays, and equally omnivorous, subsisting on fruit in addition to the varied regimen above mentioned. As previously stated, they pertain to the same natural group as the *Falconinus*, placed by the author among the Shrikes, and have nothing whatever to do with the present series.

Of the European species, two have shorter and thicker bills, and differ in some other minutie. Their plumage is prettily marked with light blue. They are the Common Blue Tit (*P. caeruleus*), so abundant in Britain, and the *P. cyanus* of Pallas. The rest have the bill longer and more pointed. The Great Tit (*P. major*), of pleasing colours, with a black median list down the belly; the Marsh Tit (*P. palustris*), with merely a black cap and throat; the Cole Tit (*P. ater*), with a conspicuous white spot on the hind-neck, and very slender bill; and the Crested Tit (*P. cristatus*), with a pointed crest, not very dissimilar from that of a Lapwing, and which is rare in this country; inhabit the British islands, the first four being every where common.

There are a vast number of others.

#### THE BOTTLELIT (*Mecistura*, Leach).—

Included by the author in *Parus*, should unquestionably be separated. The beak is very short, its upper mandible curving slightly over the lower: diet exclusively insectivorous.

The Common Bottletit (*M. vulgaris*; *Parus caudatus*, Lin.).—A very small species, with a long graduated tail, the medial feathers of which are shorter than the next pair: the young are very differently coloured from the adults, and have the tail still longer. This curious little bird builds a most elegantly domed nest with a small side opening, upon a forked branch, and rears a numerous progeny, which follow their parents till the return of spring. The form of its feet, character of plumage, habits, all are different from those of the true *Parus*: its eyelids are naked, and of an orange-yellow colour.

Very nearly allied to the Bottletits, there is a group of small Australian birds,

#### THE AURIFRONS (*Mahurus*, Vieillot).—

Which have a longer beak, resembling that of many *Beccines*, and the old males of which are distinguished by their intensely vivid tints of verditer and azure: they vary singularly in the number of tail-feathers, which, in one species, are reduced to four, that are extremely long and gauze-like, being the lowest number found throughout the class, where any exist at all.

The species are numerous; resemble the Bottletit in their mode of life, and manner of nidification; some of them even in the peculiar form of the tail, the medial or uropygial feathers of which are shorter than the next pair, and the exterior successively graduated. The African species sometimes referred to this genus have but little affinity to it.]

#### THE RAVENLINGS [*Colaptes*, Leach].—

Differ from the Tits in the form of their upper mandible, the tip of which curves over the lower.



[Their anatomy is strictly that of a Finch, and they are much more nearly related to the Waxbill Finches than to the Tits, with which latter they have little in common. The gullet has an extremely large dilatation or craw\*, and the gizzard is remarkably muscular.]

There is only one known species, the Bearded Reedling (*C. marminius*), an inhabitant of reedy districts, extensively diffused over Europe and Asia, and not rare in some parts of Britain. It is one of the most exquisitely beautiful of birds, although its colours are not vivid. The plumage is remarkably long and dense, the wings short, and tail long and graduated: general colour rich orange-brown, marked with black, white, and yellowish on the wings; the male distinguished by a pure ash-coloured head and neck, a long pointed tuft of intensely black feathers proceeding downward, like a moustache, on each side of the face, under tail-coverts of the same hue, the throat white, and a delicate mixture of lilac and other tints on the breast; beak and iris bright yellow, and feet (which are long and robust) black. The female has no black on the moustaches and under tail-coverts, and is every where less bright; and the young have a broad black stria along the back. Stripped of the feathers, this species appears singularly small, with disproportionately large legs: its apparent size is that of a Whitethroat.

The Bearded Reedling subsists on reed seeds during the season, and feeds very much on small shelled mollusks, which it finds among the aquatic herbage; its nest and eggs, placed in a tussock of grass, or among the sedges, a good deal resemble those of a Bunting, and the brood appears to follow the parents till the return of spring.]

#### THE PENDULINES [*(Agithinus, Vigora)*].—

Have the beak more slender and pointed than in the Tits, and are celebrated for their artificially-constructed nests.

There is one in Europe (*Par. pendulinus*, Lin.).—Ash-coloured, with brown wings and tail; a black band across the forehead, which, in the male, is continued to behind the eyes. This small species, an inhabitant of the east and south of Europe, is noted for its admirable purse-like nest, composed of willow or poplar down, and lined with feathers, which it suspends to the flexible branches of aquatic trees.

#### THE BUNTINGS (*Emberiza*, Lin.).—

Possess an exceedingly distinct character in their short, straight, and conical beak, the upper mandible of which, narrower and more retracted at its edges than the inferior, has a hard projecting palatal tubercle. They are granivorous birds, easily ensnared.

[Of fourteen European species, three are common in Britain, a fourth along the southern coast, not far from the sea, and a fifth sometimes occurs as a very rare straggler. The form is peculiar to the eastern hemisphere, though there are some nearly allied species in North America. All are unmusical birds, that feed their young on insects, and consume much unripe corn.]

Of the British species, the Corn Bunting (*E. miliaria*, Lin.) is the largest, and coloured like a Lark; beak stouter than in the others, and yellow in summer, horn-colour in winter; plumage of both sexes alike: frequents inclosures. The male Yellow Bunting (*E. citrinella*) is distinguished by its clear yellow crown and breast, and abounds everywhere upon hedges and furze-brakes. The Cirl Bunting (*E. ciris*) is allied to the yellow species, but smaller and shorter, with a black throat; particularly frequents the summits of elms, but breeds in the hedges, and is rarely seen far inland. The Reed Bunting (*E. schoeniculus*) has a black head and gorget, and white ring round the neck; the black concealed in winter (at least in the young, less so in the old birds,) by deciduous edgings to the feathers: it inhabits watery localities. Lastly, the Ortolan Bunting (*E. hortulana*) has a greenish head, with a pale yellow streak proceeding from the angle of the bill. It is very rare in this country, but abundant in many parts of the Continent, where, with some other species, it is fattened and eaten as a great delicacy.]

M. Meyer has distinguished from the Buntings

#### THE SNOWFLECKS (*Plectrophanes*).—

Which have a long hind-claw as in the Larks, [and lengthened wings]. Such is

The Common Snowfleck (*Emb. nivalis*, Lin.).—[Beak and upper parts deep black in summer, the rest, and the wings and tail partly, white, the feet black: in winter the black and white are more or less concealed by brown margins to the feathers, and the beak is yellow. In its nest, eggs, notes, and various other characters, this species has little relationship with the Buntings. It abounds in the most northern countries, and migrates southward in large flocks during the inclement season, when it is common in North Britain. Another species (*P. lapponica*) is of very rare occurrence in this island. Two others have been distinguished.]

#### THE FINCHES (*Fringilla*, Lin.).—

Have a conical beak, more or less stout at its base, but the commissure of which is not angular. They subsist generally on grain.

\* We are aware of no instance of this dilatation existing in any of the preceding genera of *Passerina*.

We subdivide them first into

THE WEAVERS (*Ploceus*, Cuv.).—

The beak of which is so large that some of them have been classed with the Cassicans; but the straightness of its commissure distinguishes that of the latter, and the upper mandible is moreover slightly bulging. These birds are found in both continents, and the greater number of those of the eastern hemisphere are remarkably skilful nest-builders, which interweave blades of grass, a circumstance from which they derive their name.

Such is the Philippine Weaver-bird (*Loxia Philippina*, Lin.).—Yellow, spotted with brown; throat black. Its spherical pensile nest is entered by a vertical canal, which communicates with a lateral opening of the cavity wherein the eggs are deposited.

Some of them build a vast number of contiguous nests, which form a single mass divided into numerous compartments; as

The Social Weaver-bird (*Loxia socia*, Lath.)

Among those of America, [which have been very properly separated, first into

THE BOBALINKS (*Dolichonyx*, Swainson).—

Which have stiff pointed tail-feathers], we may distinguish

The Rice-bird of the United States (*Oriolus niger* and *oriolus*, and *Corvus sirinamensis*, Gm.), innumerable flocks of which devastate the cultivated fields of several of the warmer parts of that continent.

Nomenclators have not yet succeeded in reducing to order the various black birds of America, more or less allied to the Cassicans, [near which the Bobalinks should be also placed].

THE SPARROWS (*Pyrgita*, Cuv. [*Passer*, Ray])

Have the beak rather shorter than in the preceding, conical, and merely a little bulged towards the point.

[There are five species in Europe, of which two inhabit Britain; the House Sparrow (*Fring. domestica*, Lin.), and the Tree Sparrow (*F. montana*, Lin.),—which latter has a maroon-coloured head, with the chin, and a spot on each side of the neck, black, its plumage being precisely alike in both sexes, and even the nestling young, and corresponding in its general character with that of the adult male only of the others. There are several more, all peculiar to the eastern hemisphere. The beak is always black in summer, horn-colour in winter.

We have observed that the common House Sparrow, like most other birds that nestle upon buildings, (as the Starling, Jackdaw, Rook, Pigeon, Swallow, &c.), breeds in considerable numbers in the cliffs along the sea-coast, which is doubtless its aboriginal nesting-place.]

THE CHAFFINCHES (*Fringilla*, Cuv.).—

Have the beak less arcuated than in the Sparrows, stouter and more elongated than in the Linnets.

There are three in Europe. The Common or White-winged Chaffinch (*Fring. caelebs*, Lin.); the Mountain Chaffinch, or Brambling (*F. montifringilla*, Lin.), [which visits Britain in winter]; and the Snow-finch (*F. nivale*, Lin.), which nestles in the high Alps, and descends only in the depth of winter to the secondary ranges. [This bird, now generally ranking as the *Montifringilla nivale* of Brehm, absolutely resembles the Common Snowflock in all but the shape of its beak, which latter even becomes quite black in summer, as in that species: it affords, accordingly, one of the very numerous proofs that the value of the form of the bill, as a zoological character indicative of affinity, has been much over-estimated by systematists. In the true Chaffinches, the bill turns dark bluish in summer].

THE GOLDFINCHES (*Carduelis*, Cuv.).—

Have an exactly conical beak, without any bulging; the tip prolonged to a sharp point.

[There are two groups of them, characterised by plumage, and a slight difference of habit: in the first, the colouring is gay, the beak pale flesh-coloured in summer, and its point further attenuated. These are more particularly designated Goldfinches.

But two are known, the common European species (*C. elephas*), and another in the Himalaya mountains of Asia (*C. campestris*, Gould). The first is well known as a pleasing songster.

The rest have a shorter bill, and less elongated form; the plumage variegated black and yellow, with always a black crown. They are commonly termed *Siskins*. Of numerous species, two only inhabit Europe, and one the British islands (*F. spinus*, Lin.).]

THE LINNETS (*Linaria*, Bechst. [*Linota*, Bonap.])

Have also an exactly conical bill, but which is less elongated.

In some, however, its tip is comparatively drawn out. [These are generally known as *Redpolls*; of which there are several species, not easy to discriminate: two occur in Britain—the Common or Small Redpoll (*F. minor*, Lin.), and the Mealy or Stone Redpoll (*F. campestris*, Gould), which latter is larger and stouter, with a whitish rump, that is scarcely tinged with the pink so conspicuous in the other.

The Common or Song Linnnet (*Fr. canabina*, Lin.), is remarkable for the crown and breast plumage of the male, which, in winter, is dingy reddish-brown, concealed by terminal edgings, that disappear in spring, at which season the colour changes to bright crimson: the same enhancement of tint obtains, though to a less extent, in the preceding species, the coronal and breast feathers of which are pink in winter, brightening considerably towards the breeding season. It is remarkable that none of these birds ever acquire their gay tints in captivity, although they breed freely when caged. The same applies to several allied groups, as the Crossbills and *Erythrospinae*, or purple Finches of the North, which latter are intermediate to the Linnets and *Corythi*.

There is a fourth British species, of inferior size to the last, with a smaller bill of a wax-yellow colour, and no dark tinge on the rump; the Twite, or Mountain Linnnet (*F. montium*, Gm.), which abounds in the most northern districts of the island, and upon upland heaths, migrating southward in winter.

Several species of less yellow are known as Series or Canary-birds [the]

[the] Canary, so abundantly bred in captivity (*F. canaria*, Lin.), the domesticated varieties of which are so numerous that it is difficult to assign the original colour. It hybridizes with various other Finches, producing line that are more or less capable of propagation. [The original stock is still wild in the islands from which this species takes its name: individuals occasionally learn to pronounce words with remarkable precision and articulation.]

#### THE WHIDEAHS (*Pluvia*, Cuv.)—

Are African and Indian birds, with the beak of a Linnnet, sometimes a little bulged at its base, [the males of] which are distinguished by the extraordinary elongated covert feathers above the tail, [at least during the breeding season].

They grade without assignable interval into the Linnets.

#### THE GROSBEAKS (*Coccothraustes*, Cuv.)—

Possess an exactly conical beak, which is distinguished only by its extreme thickness.

The Haw Grosbeak (*Loxia coccothraustes*, Lin.), is one of those particularly worthy of the name, [though its beak is slight in comparison with that of some others].—Crown and back chestnut-brown, neck and rump ash-coloured, beak dark bluish in summer, flesh-coloured in winter; the secondary feathers of the wing abruptly truncated. The external apparatus is figured at p. 178, as characteristic of the whole enormous group of *Passerines*. This bird inhabits wooded districts, nestles upon beech or fruit-trees, and feeds on all sorts of kernels. [Is not rare in some parts of South Britain, but in general extremely wild and shy of approach.]

The Green Grosbeak, *Green Linnnet*, or *Green-finch*, (*Lox. chloris*, Lin.)—[One of the commonest of British birds: its bill turns pale flesh-colour in summer, as in the Goldfinch.]

Among the very numerous groups of foreign Finches and Grosbeaks, a strongly marked subdivision is that of

#### THE AMADUVATS (*Amadina*, Swainson),

The beak of which is short and slightly bulging.

Such is the *Jess Sparrow*, so abundantly brought alive from the Indian Archipelago, and numerous distinctive species of pleasing colours, several of which inhabit Australia.

#### THE WAXBILLS (*Estriilda*, Swainson)—

are nearly allied, and also approximate the Reedlings: they have a smaller and somewhat arched bill, and long graduated tail.

Of several species, one is very commonly brought alive to this country, with delicate grey plumage transversely banded, and a crimson streak through the eye; beneath the tail black, as in the Bearded Reedling.

They inhabit the same countries as the Amaduvats.

#### THE PITTLUS, Cuv.

The beak as thick as in the Grosbeaks, a little compressed, arched above, and sometimes a salient angle at the middle of the upper jaw.

[Among the various groups to which the above definition is more or less applicable, we may particularly notice one lately discovered at the Gallipago Isles,

#### THE GROSPIZA, Gould,—

Wherein the beak varies singularly in shape and stoutness, notwithstanding which there is an exceedingly strong resemblance in every other character, which forbids their separation. They are chiefly ground-birds, with sombre plumage and short tails.

Mr. Gould subdivides them into *Geospiza* as restricted, with the bill of a Cardinal-finch (*Guarica*),—*Carpodacus*, with that of a *Corythus*,—*Cæstoria*, wherein the beak resembles that of an *Icterus*,—and *Struthidea*, wherein it even approaches the slender bill of an *Acceptor*].

#### THE CARDINAL-FINCHES (*Guarica*, Swainson).—

Have nearly the beak of the Grosbeaks, but slightly bulging, and are peculiar to America.

The *Virginian Nightingale*, as it is termed (*Lox. cardinalis*, Lin.), is a well-known example.

Some have the beak remarkably compressed; and a species in which this compression attains its ultimatum, constitutes

#### PARADOXORNIS, Gould.—

Wherein the curved ridge of the upper mandible forms an acute angle, its sides do not bulge, and the lower mandible is slender.

(*P. paradoxus*, Gould, resembles the preceding.)

Naturalists have long separated

#### THE BULLFINCHES (*Pyrrhula*)

Which have a rounded and every where bulging bill, [the tip of the upper mandible overhanging the lower one. Plumage soft and very dense].

The Common Bullfinch (*Loxia pyrrhula*, Lin.).—Ash-colour above, vivid tile-red below, with black cap, [tail, and wings partly, the rump white]. Female dull reddish-brown where the male is red. [Young destitute of the black cap. There is a race, considerably larger in all its proportions, but otherwise exactly resembling, in western Europe; another in Japan, differing inconsiderably in colour, but undoubtedly distinct; and a fourth on the Himalayas (*P. erythrocephala*), more strongly characterized].

#### THE CROSSBILLS (*Loxia*, Brisson).—

Have a compressed beak, the mandibles of which are so strongly curved, that their tips cross each other, and not always on the same side. This extraordinary bill enables them to extract the seeds from pine-cones with astonishing facility.

[These birds present a singular modification of the same particular type to which the Siskins and Redpole Linnets appertain; than which they are merely stouter built, with the tips of the beak still more prolonged, and anomalously modified, in adaptation to peculiar habits. The species are very indeterminate, but there appear to be several of them, successively increasing in stoutness and strength of bill, but differing in no other particular; and as one of them only is distinguished by white bars on the wing, like a common Chaffinch, which character is found in individuals only of a particular size, this circumstance militates against the rest being considered varieties of one another.

That common in western Europe (*Lox. curvirostra*, Lin.), is of medium strength, and of late years has become considerably more abundant than formerly in the British Isles, where it was previously chiefly known as an occasional and very irregular visitant. The Parrot Crossbill (*L. pytiopeltacus*, Bechst.), is larger and stouter, with a much stronger beak, the points of which rarely pass the ridge of the opposite mandible. It is of very rare occurrence in Britain, where the white-winged species (*L. leucoptera*), which is chiefly found in America, has also occurred as a straggler. The nestling plumage of these birds corresponds with that of a Redpole, and the males afterwards assume, most irregularly, a red or buff-yellow garb, brightest on the crown, breast, and rump. Their call-note, and all their actions, strikingly recall to mind those of a Goldfinch or Redpole.]

#### THE PINE-FINCHES (*Corythus*, Cuv.).—

[Are simply Crossbills, devoid of the peculiar character from which those birds derive their name, with rather softer and less firm plumage, and a beak scarcely differing from that of the Bullfinches.

They have also the same irregularity of colour, and their habits are nearly similar. One species (*C. canadensis*) is common in the northern pine-forests of both continents; there is a second in northern Asia, and the *Pyrrhula longicauda*, Tem., constitutes a third.]

#### THE COLINS (*Colinus*, Gmelin).—

Are still very near the preceding, [a remark of the author perfectly unaccountable]. Their beak is short, thick, conical, a little compressed, the two mandibles being arcuated without either passing beyond the other\*; tail-feathers [ten in number, much] graduated, and exceedingly long [and rigid]; the thumb, as in the Swifts, capable of being directed forwards like the other toes; their plumage, fine and silky, [short, dense, and smooth.] is generally of an ash-colour, [and the coronal feathers are elongated, forming an erectile pointed crest; the body feathers possess an accessory plumage, and the

\* \* The upper mandible does considerably overhang the other.—Ed.

very short ~~over~~ the rump]. They are birds of Africa and India, which climb somewhat in the manner of Parrots, live in troops, and even breed in society, constructing numerous nests in the same bushes; lastly, they sleep suspended to a branch, with the head downward, many of them together, and subsist on fruits, [the buds of trees, and tender sprouts of vegetables.

These very curious birds are closely allied by affinity to the Plantain-eaters and Touracos, and have no especial character of the *Passerinae*. They sail from bush to bush in a long row one after another, alighting always near the ground, and clambering to the topmost twig with the assistance of the beak and long stiff tail, picking off the buds or berries; and do not pass to the next until the whole flock are ready, when they again sail in the same regular succession. They are very mischievous in gardens in the Cape colony, devouring the young plants of vegetables as fast as they spring up; and are there known by the term *Muye-véget*, or "Mouse-bird;" their cry is monotonous, (having but one pair of vocal muscles,) and in the largest species closely resembles the bleating of a lamb. They constitute the ordinary food of several species of Birds of Prey, and have remarkably heavy, massive bodies, for their apparent size, the plumage lying flat and close].

Here also should be placed

#### THE OXPECKERS (*Buphaga*, Brisson), —

A small genus, wherein the beak, of medium length, is first cylindrical, both mandibles bulging towards the end, which terminates obtusely. They employ it to compress the skin of cattle, in order to force out the larvæ of *Cestridæ* lodged within it, upon which they feed. [The claws are accordingly extraordinarily sharp, to enable them to cling while so occupied.

Two species are now known, both from South Africa: they strictly pertain to the Starling family, and have no sort of relationship with the Honeyguides (near which some systematists place them), being true *Passerinae*.]

#### THE CASSICANS (*Cassicus*, Cuv.)—

Have a large beak, exactly conical, thick at the base, and singularly sharp at the point; small round nostrils pierced at its sides; the commissure of the mandibles forming a broken line, or an angle as in the Starlings. They are American birds, with manners approaching those of our Starlings, [at least in some instances,] frequently construct their nests close together, and sometimes with much art. They subsist on insects and grain, and the numerous flocks of them commit great ravages in the cultivated districts.

We subdivide them into

#### \* THE CASSICANS, properly so called, (*Cassicus*, as restricted),

Wherein the beak mounts upon the forehead, encroaching circularly on the plumage. The largest species are included in this group.

[Some are very superior songsters, and rival the Mocking-bird in mimicry.]

#### THE BALTIMORES (*Icterus*, Cuv.)—

Have the beak arcuated throughout its length, and forming only a pointed notch on the forehead.

[This name is now generally applied to the *Baltimore-birds* of North America, with some proximate species from the southern continent. They do not congregate, and build an elegant pensile nest, as do also the preceding. The males are several years attaining their mature colouring.]

#### THE TROOPIALS (*Xanthornus*, Cuv.)

Only differ from the last in having the beak straight.

[Certain of these, the true Troopials (*Agelaius*, Swainson), have a comparatively short beak, thick at the base. Their habits are those of the Starlings, and they are exceedingly destructive in the maize plantations: they breed in small societies, sometimes on or near the ground, and where opportunities occur, in the interstices of the massive nests of the Osprey; it is said that the proportions of the sexes in these little communities are very irregular, which would intimate that they do not pair\*; a circumstance the less unlikely, from their close affinity to the next, or

The *Molothrus* (*Molothrus*, Swainson); of which two species are now known, both parasitic in their mode of propagation, depositing their eggs in the nests of other birds, like the Cuckoo of Europe: these certainly do not mate. They are distinguished by a still shorter bill, and differ little in their habits from the Troopials.

Several other natural subdivisions have been instituted, of which the Bobalinks, or *Rice-birds*, have been already noticed (p. 199). The Chewinks (*Pipilo*, Vieillot), with a bulging sparrow-like bill, pertain to the same group; and there are others which approximate the Crows, as the divisions *Quiscalus*, *Scolecophagus*, &c., and even the Larks, as *Sturnella*, Swainson, the members of which have the beak obtusely pointed, like the true Starlings, and are nearly related to the Bobalinks].

The only known species (*Os. flammeiceps*, Tem.), has a partly red crest, like many Tyrants. [The affinities of this bird are most puzzling. It obviously belongs to the distinct division *Passerinae*, and therefore has no particular relationship with the Woodpeckers, contiguous to which it is arranged by some. Colour, green above, whitish and spotted like a Thrush on the breast. Inhabits Brasil.]

#### THE FITTITS, Buff. (*Decnis*, Cuv.)—

Represent the Baltimores on a diminutive scale, having the beak conical and sharp-pointed.

[They consist of some of the *Sylvicoles*, p. 191.]

#### THE STARLINGS (*Sturnus*, Lin.)—

Differ from the Troopials only by a compressed beak, particularly towards the point, [which is obtuse and nail-like.

[There are two in Europe, one generally diffused, and extending eastward to China,—

The Common Starling (*St. vulgaris*, Lin.)—At first dull brown, then finely glossed black, with a pale tip to each feather, imparting a pretty speckled appearance; the clothing feathers are successively more elongated and pointed for several moults, and most of their pale terminal spaces finally disappear altogether, the bill also becoming rich yellow. It is easily tamed and taught to speak\*, and very social in its habits, flying in large flocks: flesh bad-tasted. The other species (*St. unicolor*) has still longer pointed clothing feathers, and never any whitish spots: inhabits the south of Europe, and particularly Sardinia.]

We can perceive no characters of sufficient importance to sanction the separation, from the *Corvirostræ*, of the genera belonging to the family of Crows, which have precisely the same internal structure, as well as the same external organs, being distinguished only by a much greater size, which allows some of them to pursue other birds; their strong beak is often laterally compressed.

The genera are three in number, viz., the Crows, Birds of Paradise, and the Rollers [which last alone do not possess the distinctive characters of the *Passerinae*].

#### THE CROWS (*Corvus*, Lin.)—

Have a strong beak, more or less compressed, and the nostrils covered with stiff incumbent bristles directed forwards. They are sagacious birds, and their sense of smelling is very acute; they have generally the habit of purloining articles that are quite useless to them, as pieces of money, &c.

We apply the name of Crow, or Raven, more particularly to certain large species, which have the stoutest beaks of any, and the ridge of the upper mandible most arcuated. Their tail is round or square.

The Raven (*C. corax*, Lin.), is the largest Passerine bird found in Europe, equalling a fowl in size. Its plumage is wholly black, the tail rounded; ridge of the upper mandible arched anteriorly. Its habits are more retiring than those of its congeners, [except where it is quite unmolested]; flight, vigorous and lofty; scents carrion at the distance of a league; and also feeds on fruit and upon small animals, even carrying off poultry; it nestles on lofty trees or in steep precipices, is easily tamed, and readily learns to speak. This bird appears to be found in all parts of the world, [a fallacious opinion, very generally received: few travellers that have seen a large black species of *Corvus* have troubled themselves to ascertain that it was the *Raven*; and collectors have generally neglected to procure a bird, which they supposed was not uncommon at home; the truth being, that there are, as many as six or seven species confounded under the name, several of which are readily distinguishable upon actual comparison. The similitude of the common Crow and Rook of Europe should have rendered naturalists cautious in identifying the species of this genus].

The Corby Crow (*C. corone*, Lin.)—A fourth less than the Raven, with a square tail, and beak less arcuated.

The Rook (*C. frugilegus*, Lin.)—Smaller still, with a [comparatively] straight beak, more pointed than that of the last. Excepting when young, the head is bare of feathers as far back as the eyes, which the bird probably wears off in digging up the grubs on which it feeds.

These two species live in great flocks, nestling even in society; [certainly, however, not the first of them]. They devour grain as well as insects. Are found throughout Europe; remaining in the winter, however, only in the milder districts. [The Corby Crow is much more carnivorous than the Rook, and very destructive to eggs and young game: we have known it attempt to fly off with a young Turkey nearly as big as itself: it is very common that the Rook attacks other birds, but we have known a party of this species to destroy a brood of *Mimus* Thrushes that had recently left the nest.]

\* We have known a Spaffling to learn the song of the Nightingale, and warble it to perfection.

#### THE MAGPIES (*Pica*, Cuv.)—

have both mandibles like the Crows, [and slighter built]; have also the upper mandible more arcuated than the lower, and the tail long and much graduated.

The European Magpie (*Corv. pica*, Lin.)—A very handsome bird, of a silky black, with purple, blue, and bronzed reflections: the belly white, and a great white patch over each wing. Its continual chattering has rendered it celebrated. It prefers the neighbourhood of human habitations, and subsists on all sorts of food, even carrying off young poultry. [Specimens from North America are undistinguishable; but there is another species in that continent, with a yellow bill, and differently bronzed tail (*P. Nuttallii*, Aud.); and we have seen a species from Norway, hitherto undescribed, much smaller in all its proportions than the common Magpie, with tail resembling that of the Yellow-billed species. We will term it *P. scandiaca*.

There are several birds nearly allied, with magnificent azure plumage; and some with shorter bills, and more strictly arboreal conformation, as the Indian *P. vagabunda*, which compose the *Dendrocitta* of Gould].

#### THE JAYS (*Garrulus*, Cuv.)—

Have both mandibles slightly elongated, and terminated by a sudden curve; when the tail is graduated, the bill is more lengthened; and the frontal feathers, lax and disunited, are more or less erected when the bird is excited.

The European Jay (*Corv. glandarius*, Lin.) is a handsome bird, of a vinaceous-grey colour, with black quills and moustaches, and a beautiful mottled patch on each wing, rayed with bright blue. It subsists principally on acorns during the season. Is very imitative, and nestles in our woods, living in pairs or families. [There are two closely allied species—the Syrian Jay, distinguished by a black crown, and that of Japan, which has black cheeks; the proportions of the ornamental patch on the wing are also different. Other proximate species occur on the Himalaya mountains.

The Jays with longer and more slender bills, and graduated tails, are all smaller, and constitute the *Cyanocorax* of Boie, in part. There are four species in North America, of which the well-known Blue Jay (*G. cristatus*) affords a familiar example. A species of this group occurs on the Himalaya mountains of Asia, and we are disposed also to refer to it the *Pica cyanea*, Wagler, common in Spain. The Whiskev-jacks (*Perisoreus*, Bonap.) compose another small natural group, scarcely differing from the *Parus* in structure, and but little in habit: the European *Corv. nescius*, Lin., and *C. canadensis*, Lin., of North America, belong to it.]

#### THE NUTCRACKERS (*Caryocatactes*, Cuv.; *Nucifraga*, Vieillot)—

have both mandibles equally pointed, straight, and without curvature.

The European Nutcracker (*Corv. caryocatactes*, Lin.)—Brown, speckled with whitish all over the body. It nestles in the holes of trees, in dense mountain forests; climbs trees and perforates their bark, like the Woodpeckers; levours all sorts of fruit, insects, and small birds; and sometimes comes in flocks into the plains, but without regularity. Is celebrated for its confidence. [There is a larger species, closely allied, on the Himalayas; and a third in America, without any spots, the *Corvus columbianus*, Wilson].

#### THE TAMIA, Vaillant (*Crypeirina*, Vieillot; *Phrenotris*, Horsfield).—

With the front and tail of the Magpies, combines an elevated bill, and bulged upper mandible, the base of which is adorned with velvety feathers, nearly as in the Birds of Paradise.

The first-known species (*Corv. varians*, Latham) is of a bronzed green colour. These birds are found in Africa and India.

#### THE GLAUCOPIS, Forster,—

A similar beak and front, but two fleshy caruncles at the base of the bill.

The known species (*Gl. cinerea*, Lath.), inhabits New Holland, and is the size of a Magpie, blackish, with a graduated tail; it lives on insects and berries, seldom perches, and is esteemed good eating.

#### THE ROLLERS (*Coracias*, Lin.)—

Have a strong beak, compressed towards the tip, with the point of the upper mandible a little hooked oblong nostrils, placed at a slight distance from the plumage, and not covered by incumbent feathers the feet short and stout [with their outer and middle toes free to the articulation]. They are peculiar to the eastern hemisphere, and bear some resemblance to the Jays in their manners, and in their frontal feathers; are vividly coloured, but in general not harmoniously.

the members of which take their food commonly on the wing, lay numerous polished white eggs, of an almost spherical shape, in holes of some description, collecting no nest; the young retaining their first plumage, which is little less bright than that of the adult, until the second autumn: the whole of them subsist exclusively on animal diet].



Fig. 94.—Sternum of Roller.

THE ROLLERS, properly so called,—

Have a straight beak, higher than broad, [and comparatively elongated].

There is one in Europe (*C. garraia*, Lin.).—Vivid sea-green, with reddish-fulvous back and scapularies; some pure blue at the bend of the wing; and size about equal to that of a Jay. It is a very wild bird, though social with its own kind; noisy; which nestles in the holes of trees in the forests, and leaves at the approach of winter. It feeds on worms, insects, and small Frogs. Some have the exterior tail-feathers elongated, [as in the common Swallow; and there is one species, inhabiting South Africa, which is stated to perch and watch for prey on the horn of the Rhinoceros, giving notice to that animal of the approach of the hunter].

THE ROLLES (*Colaris*, Cuv., *Eurystomus*, Vieillot),

Differ from the preceding by having a shorter and more arcuated bill, and particularly by its being widened at the base, which is broader than high.

[The species are less numerous; and there is one inhabiting Australia.]

THE BIRDS-OF-PARADISE (*Paradisæa*, Lin.);

Have a straight, compressed, stout, and unemarginated beak, with covered nostrils, as in the Crows; but the influence of the climate they inhabit, which extends to birds of several other genera [so far as the beak is concerned], imparts a velvety texture, and frequently also a metallic gloss, to those feathers which overlie the nostrils, while the plumage of various other parts acquires a singular development. These birds are indigenous to New Guinea and the neighbouring islands. From the mode in which the specimens brought to Europe are prepared by the savages of those countries, it was formerly thought that they were quite destitute of limbs, and supported themselves entirely by their airy plumes. It is said that they live on fruits, and are particularly fond of aromatics. [They also subsist largely upon insects.]

Some of them have thinly-barbed feathers on the flanks, [or rather shoulder-tufts, which cover the closed wing,] inordinately prolonged, so as to form immense tufts, that extend far backward beyond the body; there are also two [generally] barbless filaments [the uropygials] attached to the rump, which are even more elongated than the airy lateral plumes. Such are

The Emerald Bird-of-Paradise (*P. apoda*, Lin.), which is the most anciently known species; and the Bird (*P. rubra*, alliant). These compose the *Samalis* of Vieillot. [They are large birds, much more so than the contracted kinds brought to Europe, which are evidently shrunk by the application of great heat; would lead to suppose: it is only in such specimens that the wings and legs appear disproportionately large.]

Others have the same long filaments, but their lateral tufts, though still elongated, do not extend past the tail. As The King Bird-of-Paradise (*P. regia*, *Cincinurus regius*, Vieillot), and the Magnificent B. (*P. magnifica*, Sonnerat), [which are very distinct, generically, from the preceding].

Some have the thinly-webbed feathers on the flanks, but they are short, and the filaments on the rump are wanting, as

The Six-stemmed B. (*P. sixes*, Gm.; *P. sixesceses*, Shaw), with a golden-green spot on the throat, and three long filaments proceeding from each ear, which are terminated by a small disk of barbs of the same colour. It constitutes the *Paradisæa* of Vieillot.

Lastly, there are some with neither elongated filaments nor lateral tufts (the *Lophorina*, Vieillot), as The Superb B. (*P. superba*, Sonnerat), and the Golden B. (*P. aurea*, Shaw; *Oriculus aureus*, it is congeneric with the Australian Regent-bird, and therefore a *Serrirostris*].

The fourth family of the *Phœvinae*, or that of



them. They bear the same relation to the *Conirostres* which the *Beo-fins* do to the *Alcedinæ*.

#### THE NUTHATCHES (*Sitta*, Lin.),—

Have a straight, prismatic, pointed beak, compressed towards the tip, which they employ like the Woodpeckers to perforate the bark of trees, [and particularly to scale it off], to get at their insect-food; and although they climb in every direction, they have only one toe directed backward, which is certainly very strong. Their tail is of no use in supporting them, as in the Woodpeckers and Tree-creepers. [These birds also feed largely on various seeds, and are celebrated for the instinct of fixing a nut in a chink, while they pierce it with the bill, swinging the whole body as upon a pivot, to give effect to each stroke. They lay up stores of food, like the Tits.]

Of several species, three inhabit Europe, and one the British Isles, which is not uncommon (*S. europæa*, Lin.).—Ash-grey above, yellowish beneath, with dark rufous flanks and under tail-coverts, the latter spotted with white; a black streak through the eye, and round white spots on the tail-feathers; size, that of a Robin. Its note is remarkably loud, and disposition fearless.]

#### THE XENOPS, Illiger,—

Have merely the beak rather more compressed, and its inferior ridge more convex.

#### THE ANABATES, Temminck,—

Have, on the contrary, the superior ridge a little convex, almost like the beak of a Thrush, without emargination. The tail is long and wedge-shaped, and occasionally worn, which intimates that it is employed for sustentation. In

#### THE SYNALLAXIS, Vieillot,—

The beak is straight, not much elongated, slender, and pointed; the tail-feathers are generally long and sharp. There are even some of them in which the shafts of those feathers are stout, and prolonged beyond the barbs.

#### THE CREEPERS (*Certhia*, Lin.)—

Have an arcuated bill, but little else in common. We subdivide them first into

#### THE TREE-CREEPERS (*Certhia*, Cuv.),—

So named from their habit of traversing the boles of trees, in the manner of the Woodpeckers, [that is, in an ascending direction only], their tail, which terminates in similar stiff points, serving to support them.

There is one in Europe, the European Tree-creeper (*C. familiaris*, Lin.), a diminutive species, reddish-brown above, speckled with whitish, inclining to ferruginous on the rump, and pure glistening white underneath. It nestles in the holes of trees, and ascends their trunks with rapidity, searching for the insects and larvae concealed in their chinks, and among the mosses and lichens. [Is very common throughout Britain.]

America produces some true Creepers of comparatively large size, which have been termed

#### DENDROCOLAPTES, Hermann.

Their tail is the same, but the beak is much stronger and wider.

There is even one of them which approaches the Nuthatches in its straight and compressed beak: it might be taken for a Nuthatch with a worn tail (*Ortocolus piens*, Gm. and Lath.; *Gracula picoides*, Shaw; or *Dendr. guttatus*, Spix).

The beak of another, twice as long as the head, is arched only towards the tip (*le Nascean* of Vaillant). That of a third is long, slender, and as much arcuated as in *Melothreptus*.

#### THE TICHODROMES (*Tichodroma*, Illiger),

Or *Wall-creeper*, do not lean upon the tail, although they creep up walls and rocks as the preceding do the trunks of trees, but they cling to them with their strong claws. Their beak is triangular and depressed at its base, very long and slender. [They moult twice in the year.]

One only is known, an inhabitant of the south of Europe (*Certhia muraria*, Lin.). It is a handsome bird of a light ash-colour, with some bright red on the wings. Throat of the male black [in summer. The plumage of this curious little bird are not obvious].

#### THE HONEY-SUCKERS (*Nectarinea*, Illiger)—

Neither use the tail, nor indeed climb, although their beak, of medium length, arcuated, pointed, and compressed, resembles that of the Tree-creepers. All of them are foreign.

THE PROMEROPS, AND *C. erythrogastrus*, *edwardsii*, ARE AMERICAN SPECIES, TO WHICH WE ADD  
 also a very long-tongued the *Caracara*, Vieillot:  
 the largest and least handsome of them, wherein the tongue is short and cartilagi-  
 nous; the *H. of Syrix*, which constructs a nest upon shrubs, arched over like an oven, and of which  
 found genus *Opetiorhynchus*; and M. Vieillot his *Pernis*. The *Syrix* does

which

#### DIOCEUM, Cuv.

Members of this group also do not climb, nor employ the tail: their arched and pointed beak, and the head, is depressed and widened at its base.

They inhabit the East Indies, are very small, and have generally some scarlet on their plumage.

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#### MELITHEREPTUS, Vieillot,—

It is also not used, and the beak is extremely elongated, and curved almost to a semicircle. They  
 inhabit the South-sea Islands.

A species (*Certhia vestitaria*, Shaw) is covered with scarlet feathers, of which the natives of the Sandwich  
 manufacture the beautiful mantles of that colour, which are so highly prized.

#### THE SUN-BIRDS (*Cinnyris*, Cuv.)—

They do not lean on the tail; the edges of their long and very slender beak are finely serrated; the tongue,  
 which is capable of protrusion, terminates in a little fork. They are small birds, the males of which  
 have most brilliant metallic colours during the season of propagation, approaching the Humming-  
 birds in beauty; of which, in this respect, they are the representatives in the Eastern Continent,  
 being found principally in Africa and the Indian Archipelago. They subsist on the nectar of flowers,  
 which they suck up; are of a lively disposition, and sing agreeably. Their beauty renders them a great  
 ornament in our cabinets; but the garb of the female sex, and of the male in winter, is so different  
 that the species are not easy to characterize.

In some, the tail is even; in others, its two middle feathers are elongated in the males; and some are distin-  
 guished by a straight beak, or nearly so. [In most of the true *Cinnyridae*, the lateral tuft of feathers, so enor-  
 mously developed in the Birds of Paradise, exists, of small size].

#### THE SPIDER-CATCHERS (*Arachnotheres*, Tem.)—

Have the same long, arcuated beak, as the Sun-birds, but stronger and not denticulated; their tongue is  
 short and cartilaginous, and the known species inhabit the Indian Archipelago, where they live on  
 Spiders.

After all these distinctions, there are still other birds that should be separated from the great genus  
*Certhia*, some of which are merely Philodons, with the characters of that genus more developed.

#### THE HUMMING-BIRDS (*Trochilus*, Lin.).

These diminutive birds, so celebrated for the metallic lustre of their plumage, and particularly  
 for the scale-like feathers, brilliant as gems, which offer a peculiar structure, have a long slender beak  
 inclosing a tongue capable of protrusion upon the same principle as that of the Woodpeckers, and which  
 is split, almost to its base, into two filaments, employed, as is asserted, in sucking up the nectar  
 from flowers. They also, however, feed on small insects, for we have found their stomach filled with  
 Their very small feet, great tail, excessively elongated and narrow wings, and their very large

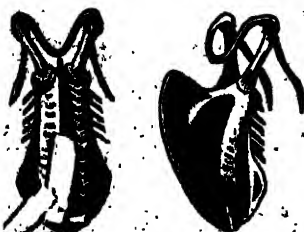


Fig. 10.—Stomach of Humming-bird.

(fig. 95) without posterior emargination, combine in a  
 mode of flight similar to that of the Swifts, besides which the Hum-  
 ming-birds balance themselves in the air by a rapid motion of  
 wings, like many Flies. It is thus they hover about flowers,  
 shrubs and plants, and fly more rapidly than any other bird. The  
 gizzard is very small, and they have no coeca, in which they  
 proximate the Woodpeckers. They live singly, defend their  
 with courage [attacking, with their needle-like bills, the eye  
 an intruder, which renders these minute creatures truly fer-  
 ocious], and fight with one another desperately.

The whole anatomy of a Humming-bird, internal as well as external, is so different at once from the Swifts: the beak and tongue even of which, though so different at first sight, are yet only in not being drawn out. The Humming-birds, however, are distinguished by their bill, devoid of articulation with the usual number of joints: their tail-feathers, as in the Swifts, are ten in number, but in the other species (thence named *T. amicurus*), wherein they are reduced to six; the body-plume, &c. The beak varies exceedingly, in being more or less prolonged, straight, or recurved, like that of an Avocet, two species exhibiting which structure are now known: those employ like the beaks feed chiefly on minute insects, and have often the tip of the tongue furnished with retroflexed bristles, precisely as in the Woodpeckers; while in the majority with curved bills, the upper mandible encloses the lower, forming a tube and admirable sucking instrument, adapted for drawing up the nectar, which is between the tongue and palate: the tail assumes every form in different species, and some have the central quills extraordinarily thickened; many have ornamental tufts of feathers, most variously disposed; fixing short, the greatest variety of modifications are observable of the one general type, (which is not *passerina*), give it is difficult or even impossible to institute satisfactory subdivisions.

Not less than a hundred and seventy species are now known, and others are constantly being discovered from America, and, with few exceptions, from the southern division of that continent. The smallest (as when plucked, are less than a large Bumble Bee; and one only, that is much larger than any others as yet white; (*T. gigas*, Auct.), nearly equals the common Swift in size: this bird is also one of the duller-coloured, its general resemblance to the Swifts is very manifest. Many, like the Swifts, employ a secreted mucus\* in the construction of their nest, which is mostly placed on a horizontal, lichened bough; and they lay two similar eggs, of an elongated form, that produce generally male and female.]

Among

#### THE HOOPPOES (*Upupa*, Lin.),

We first arrange

#### THE CHOUGHs (*Fregilus*, Cuv.).—

Wherein the nostrils are covered by feathers directed forwards, a character which has induced some authors to place them with the Crows [most unquestionably their true station], to which their habits approximate. The beak is rather longer than the head, [slender, a little arcuated, singularly brittle and much resembles red coral].

The European or Red-legged Chough (*Corvus graculus*, Lin.).—Nearly the size of a Rook, and glossy black, with red bill and legs. Inhabits the loftiest Alps and Pyrenees, and nestles in the crevices of rocks, like the Chocor than which it is less common, and also less gregarious. Fruit and insects are equally its food, and when it descends into the valleys, its presence is a sure forerunner of snow and bad weather. [This bird is not rare on many parts of the sea-coast of Britain, breeding in the highest cliffs, but upon none of our mountains, though occasionally in lofty buildings near the sea: parties of them are not unfrequently observed on Salisbury Plain, which is considerably inland; and their appearance is there considered an indication of stormy weather. They have all the manners, intelligence, thieving propensities, &c. of the Crows and Magpies, but invariably avoid walking upon turf: their claws are hooked and very sharp, enabling them to cling to the face of perpendicular cliffs, while they insert their lengthened slender bill into crevices, picking out minute insects, which constitute their chief food. The bill and feet of the young are coloured white in the nest, but less brightly than those of the adults. Three or four additional species are known, one from New Holland.]

#### THE HOOPPOES, properly so called, (*Upupa*).—

Have a double range of long erectile feathers on the head, forming a splendid crest.



Fig. 56.—Drawing of Hoopoe.

[They possess none of the exclusive characters of the *Passerina*, and, upon the whole, resemble most nearly the Hornbills, from which they differ, however, in several obvious particulars. They have a wide gape, and tongue very short and heart-shaped; the mandibles much prolonged, obtusely terminated flat, and not even grooved within; nostrils exposed, and a little removed from the base: the feet resemble those of a Lark, but are adapted for ascending steep surfaces, resting on the tarsal joint: ten tail-feathers only; a membranaceous stomach; short intestines, probably devoid of coeca; and a peculiar sternal apparatus (fig. 96). Flight undulatory, like that of the Woodpeckers, while they also resemble in their mode of tapping with the bill. It is altogether one of the most isolated genera of Birds.]

The European Hoopoe (*U. epops*, Lin.).—Of a rufous-chestnut colour, variegated with black and white: it searches for insects in humid ground, nestles in the holes of trees or walls, and migrates southward in winter; [is singularly remarkable for its intelligence and susceptibility of attachment. There are one or two others, all peculiar to the eastern hemisphere].

\* This is, in my, not analogous to the mucous focus with which the Eucalypt Swallow builds; the Humming-birds, like the Woodpeckers, employ the same substance in building their nests, in which the Swifts resemble them.

## PASSERINÆ.

### THE PROMEROPSES (*Promerops*, Brisson).—

Are not crested, but possess a very long tail; their tongue, furcate and extensile, enables them to suck the nectar of flowers, like the Humming-birds and Sun-birds.

[There are many species, found only in the warm regions of the eastern hemisphere.]

### THE EPIMACHUS, Cuv.,—

Consists of Birds, which, with the beak of the Hoopoes and Promeropses, combine velvety or scale-like feathers, which partly cover the nostrils, as in the Birds-of-Paradise; they inhabit also the same countries, and have equally gorgeous plumage. The males have even tufts of lengthened feathers, more or less produced, upon the flanks.

The Superb Epimachus (*Upupa magna*, Lin.).—Black, with a graduated tail, three times longer than the body; the feathers on the flanks elongated, turned up, and frizzled, with the edges of a burnished steel-blue; and most magnificent coloured glosses on the plumage generally.

Naturalists have distinguished the square-tailed species, or

### THE PTILORIS, Swainson,—

Such as the Twelve-wired Epimachus (*Ep. albus*; *Paradiæa alba*, Blum.), which was long ranged among the Birds-of-Paradise, on account of the long bunches of white plumes which decorate its flanks, the stems of them being prolonged into six barbless filaments on each side. The body is usually violet-black, and the feathers on the bottom of the breast have an edging or border of emerald green. *Ep. magnificus*, Cuv., and *Ep. regius*, Lesson, are two other superb species of this subdivision.

The second and smaller principal division of the *Passerinæ* consists of Birds wherein the outer toe is nearly as long as the middle one, and connected to it as far as the second joint. We make but one group of them, that of

### THE SYNDACTYLI,

Long since divided into five genera, which we retain. [None of them are modified upon the distinct type of the *Passerinæ*.]

### THE BEE-EATERS (*Merops*, Lin.).—

Have a lengthened beak, triangular at its base, slightly arcuated, and sharp-pointed. Their sternum (fig. 97) is doubly emarginated behind: [they have a membranaceous stomach, and no cœca; a short and heart-shaped tongue, and very thick skin.] Their long and pointed wings, and short feet, render their flight similar to that of a Swallow. They pursue insects in flocks, and particularly Bees and Wasps, by which it is remarkable that they are never stung [seizing the insect and at once crushing it by the snap of their powerfully compressive beak: are peculiar to the eastern hemisphere, and nearly allied to the Kingfishers and Rollers.

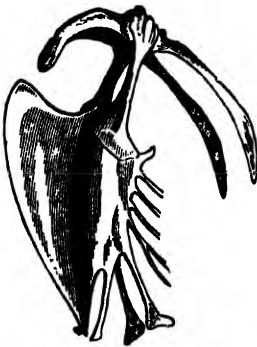


Fig. 97.—Sternum of Bee-eater.

These birds have brilliant plumage, and tail variously shaped, but generally with the uropygial feathers elongated: they excavate deep holes in banks, like the Kingfishers, and lay similar spherical polished white eggs, six or eight in number; the young retaining their first plumage till the second autumn.

Of numerous species, there is one common in the south of Europe during summer, but rare in the latitude of Britain, which it seldom visits (*M. apiastor*, Lin.): another (*M. persicus*, Pallas), visits the south-east of Europe. These birds often watch their prey from the summit of trees, to which they return after skimming about for a minute or two.

It is necessary to distinguish from them

### THE NYCTIORNIS, Gould,—

Which have shorter beaks, and softer and denser plumage, loose and puffy upon the throat. Their habits are crepuscular or nocturnal, and their distribution is confined to Asia.

Three or four species are known, which are very noisy during their time of activity].

The Bee-eaters are represented in America by

### THE MORMONS (*Pipilo*, Illiger).—

Which have the same feet and port [their tarsi being however longer], but differ by a stronger bill.

both mandibles of which are serrated, and by having the tongue barbed like a feather, as in the Toucans; [also short and round wings]. They are handsome birds, approaching the size of a Magpie, with lax feathers on the head, as in the Jays, [and similar loosely-webbed plumage generally,] a long graduated tail, the two middle feathers of which are stripped of their barbs in the adults for a short space near the end, which occasions a particular form of tail, [this singular mutilation being performed by the birds themselves]. They fly badly, live solitarily, nestle in holes [burrowed in sand-hills], subsist on [fruit and] insects, and even prey on small birds and other animals.

[They are intermediate to the Bee-eater and Roller group, and that of the Toucans, but perfectly distinct from either: the stomach is stated by Le Vaillant to be tolerably fleshy. Six or seven species are known].

#### THE KINGFISHERS (*Alcedo*, Lin.)—

Have feet still shorter than in the Bee-eaters, the beak longer, straight, angular, and pointed; the tongue and [in some instances] the tail very short. Their sternum (fig. 98) has two posterior emarginations, as in the Rollers and Bee-eaters. They live on small fish, which they take by precipitating

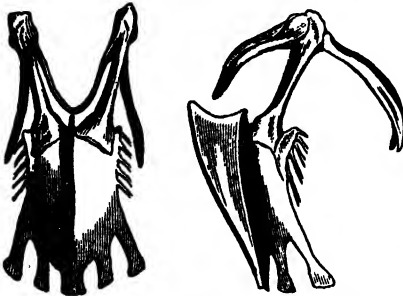


Fig. 98.—Sternum of Kingfisher.

themselves into the water from some branch, [or arresting themselves suddenly during rapid flight, poising for an instant and then plunging], and return to their perch to gulp their prey, [which they first kill by repeatedly beating it against the bough]. Their stomach is a membranous sac, [the intestines very long and slender, and without cæca]. They nestle like the Bee-eaters in holes of banks, and are found in both continents.

That common throughout Europe (*A. ispida*, Lin.), is little larger than a Sparrow, of a mottled verditer green above, with a broad band of splendid ultramarine-blue along the back; the under-parts rufous. [It exemplifies the group to which *Alcedo* is now more particularly restricted, with he-

ron-like beak, short and rounded wings, splendid colouring, and very short soft tail; the members of which, all of small size, are peculiar to the eastern hemisphere.

Others, with similar beak, have little or no vivid colouring, longer wings and tail, and some are of much larger size,—the *Ceryle* of Boë. Species are found in both continents, and one (*A. rudis*, Lin.) inhabits the east of Europe. Of the natural group of Rollers, Bee-eaters, and Kingfishers, the present subdivision is the only one found in the New World.

Numerous other species have lighter and inflated bills, resembling those of Storks; the wings and tail as in *Ceryle*, the latter in a few instances uneven: they prey on insects, and some of the larger species on crustaceans, and are known as the Halcyons (*Halcyon*, Swainson).

Others, again, inhabit desert regions, which they traverse in search of Snakes and other reptiles: they have the general form of the Halcyons, with beak rather more approaching that of the true Kingfishers. They constitute the *Dacelo* of Leach, which comprehends the largest species of any: are peculiar to Australasia and Australia, in which latter country the most celebrated species (*D. gigantea*), which is remarkable for its loud and grating prolonged cry, is not uncommon.]

#### THE CERYX, Lacepede,—

Merely differs from the ordinary Kingfisher in the absence of the inner toe.

There are three species in India, [which less require to be separated than the preceding].

#### THE TODIES (*Todus*, Lin.)—

Are small American birds, nearly similar to the Kingfishers in their general form; and which have the same feet and elongated bill, except that the latter is horizontally flattened, and [generally] obtuse at its extremity, the tarsi being also more elevated, and the tail less shortened. [They have a small and tolerably muscular gizzard, and shorter intestines than perhaps any other bird, with great pedicellate, dilated cæca, resembling those of the Owls: the sternum is doubly emarginated, and similar to that of the Kingfisher (fig. 98), except that it is much shorter, with the crest very low: the tongue is prolonged into a very thin lamina, like that of the Jacamars.] They live on insects, and nestle in the ground, [burrowing like the Kingfishers, but laying fewer eggs, which are spotted with buff or rust-colour.

Three or four species are now known, all chiefly vivid-green, varied with other colours on the throat. They

have no affinity with various small flat-billed members of the Tyrant-flycatcher group, which have often been arranged with them by superficial writers].

We terminate the notice of this order by the most extraordinary of its genera, which bears less resemblance to the other *Syndactali* than the latter do *inter se*, and which might very properly be ranged as a separate family.

#### THE HORNBILLS (*Buceros*, Lin.)—

Great birds of Africa and India, the enormous [arched and] dentelated beak of which is surmounted by a protuberance, sometimes as large as the beak itself, or which latter is at least very much inflated above, as remarkably so as in the Toucans; while their port and habits approximate them to the Crows, and their feet are similar to those of the Kingfishers and Bee-eaters. The form of the rostral excrescence varies much with age, and in very young individuals there is even no trace of it perceptible; its interior is generally cellular, [or permeated by a fragile network of osseous fibres]. The sternum has but one slight emargination on each side behind, [and is otherwise peculiar]. The tongue is short [and heart-shaped, as in the Hoopoes, and the Roller, Bee-eater and Kingfisher group], and deep in the throat. [The stomach moderately muscular, and intestines rather short and without cœca: they have only ten tail-feathers (as in the Hoopoes), and body-plumage short upon the rump, and everywhere destitute of the supplementary plume to the feathers: the eyelids are fringed with stout lashes, as if to guard the eyes from falling particles of dust disengaged by the rostral protuberance, however that may be employed, which is unknown.\* The bones are more completely permeated by air than in any other genus, the ambient fluid penetrating even the phalanges of the toes]. They subsist on all sorts of food, devouring tender fruits, chasing Mice, small birds and reptiles, without disdaining carrion; [and breed in the hollows of decayed trees, producing four rounded white eggs.

The species are very numerous, and one alone is distinguished from the rest by having a solid bony protuberance to the bill, of medium size. The flight of these birds is sailing, and resembles that of a Crow; and on the ground they advance by a leaping mode of progression, assisted by the wings: the larger species are extremely shy and difficult of approach, and they always perch on the decayed branches of lofty trees, where their vision can command a wide range. It requires to be confirmed that any of them feed on vegetable diet when in a state of nature.]

### THE THIRD ORDER OF BIRDS,—

#### THE CLIMBERS,† [*ZYGODACTYLI*, Tem.]—

Consists of species wherein the outer toe is directed backward like the thumb [except in the Trogons, where the first and second toes are opposed to the third and fourth], from which results a more efficient grasp, which certain of the genera avail themselves of to cling to the trunks of trees, and so climb up them. The name of CLIMBERS (*Scansores*) has, therefore, been appropriated to this division, although it does not rigorously apply to all its component members, and there are also several birds that climb equally well, the toes of which are disposed in the ordinary manner, as the Tree-creepers and the Nuthatches.

The Birds of this order nestle generally in the holes of decayed trees; their flight is [ordinarily] but moderate; their nourishment, as in the *Passerina*, consists of insects and fruits, according as the beak is more or less robust; and certain of them, as the Woodpeckers, are provided with special means of obtaining it.

In the greater number of genera, the sternum is doubly emarginated at its posterior edge; but in the Parrots [which have no sort of affinity with any of the rest] there is merely a hole or foramen, and often not even this.

#### THE JACAMARS (*Galbula*, Brisson)—

Hold a near relationship with the Kingfishers by their lengthened beak, which is pointed, with a sharp upper ridge, and by their short feet, the two front toes of which are connected to the second joint;

\* The Ani (*Crotophaga*) which have a very similar elevation of the beak to that of several of the smaller Hornbills, have also the eyes guarded by lashes. † More properly speaking, yoke-footed birds, as the greater number of them do not climb.—Ed.

these, however, not being the corresponding toes to those which are joined together in the Kingfishers. [The sternal apparatus (fig. 99) is most nearly related to that of the Bee-eaters, but much shorter, with a lower medial ridge; the Jacamars thus holding the same analogy with those birds which the Todies do to the Kingfishers; and like the Todies, they have also a considerably lengthened, exceed-



Fig. 99.—Sternum of Jacamar.

ingly thin, lamina-like tongue, a small and rather muscular gizzard, short intestines, and similar great cæca: both genera are very slightly made, have exceedingly thin skins, and soft puffy plumage (the character of the feathers being however different); the nostrils are a little removed from the base of the bill, and quite exposed; the gape is furnished with vibrissæ; and they subsist by taking insects in the manner of a Flycatcher]. Their feathers have always a brilliant metallic shine. They live solitarily in humid woods, and nestle on low branches, [or, more probably, as Le Vaillant was informed, in the holes of trees, laying blue eggs].

The American species have a long beak, which is quite straight [the diagnosis of the restricted *Galbula*.] These are much more numerous than the following.

Others, from the Indian Archipelago, [a mistake of Le Vaillant, all the species inhabiting America, like the Todies,] have a shorter and more inflated beak, which is a little arched, and thus approximates that of the Bee-eaters. Their anterior toes are more separated. They constitute the *Jacamerope* of Le Vaillant, and that naturalist even figures one species devoid of the ridge to the upper mandible.

Lastly, there is one in Brazil, which has only three toes.

#### THE WOODPECKERS (*Picus*, Lin.)—

Are well characterized by their long, straight, and angular bill, the end of which is compressed into a wedge adapted for perforating the bark of trees; by their slender vermiform tongue, armed towards the tip with lateral retroverted spines, and which, by the action of the elastic cornua of the hyoid bone, can be thrust far out from the beak: and finally by their tail, composed of ten feathers with stiff and elastic stems, which serve them as a support in climbing, besides which the twelfth pair of tail-feathers invariably exist externally, of minute size. They are pre-eminently climbing birds, which traverse the bark of trees in every direction, [or rather, like the Tree-creepers, they are unable to proceed in a downward direction, otherwise than obliquely backward; whereas the Nuthatches and Barbets climb perpendicularly upward or downward with equal facility]; striking with the beak, and insinuating their long tongue into chinks and crevices, to draw out the larvæ of insects on which they feed, [besides which, some of them subsist largely on acorns and nuts, even upon soft fruits, and on eggs.\*] The tongue, in addition to its armature, is supplied with a viscid mucus secreted by large salivary glands, [which mucus is conveyed by a double duct that opens at its tip]: it is retracted by two muscles wound like ribands round the trachea, and when thus drawn in, the horns of the *os hyoides* slide round the skull beneath the skin nearly to the base of the upper mandible, the sheath of the tongue corrugating into folds at the bottom of the throat. Their stomach is nearly membranous, [though considerably less lax than in the Cuckoos]; and they have no cæca.† Shy and wary, these birds pass the greater portion of their time solitarily, and, at the nuptial season, may often be heard summing the female by rattling the beak against a dead branch. They nidificate once a year in the holes of trees, and both sexes incubate by turns.

[The species are extremely numerous, and generally distributed, with the exception of Australia. The great majority have crimson feathers on the head, and the largest of them have the rest of the plumage mostly pied with white. Such, in America, are the great Californian Woodpecker (*P. imperialis*, Gould,) and the Ivory-billed and Pileated Woodpeckers, wherein the actual texture of the beak closely resembles ivory; also, the Great Black Woodpecker of Europe, which is stated to have been sometimes met with in Britain.

Others, forming an extremely numerous group, the *Dendrocopus*, Swainson, differ little but in being smaller and more mottled with white. They inhabit, like the former, northern or mountain districts, feed much on nuts and acorns, and never descend to the ground. Of four in Europe, two inhabit Britain, the *Picus major* and *P. minor*, Auctorum.

Some, the *Apternus*, Swainson, are destitute of the ordinary hind-toe. There are several species, and one in northern Europe (*P. tridactylus*, Lin.)

Many of those of tropical climates have full soft crests, and generally bald necks: these constitute the *Malacolophus*, Swainson.



Fig. 100.—Sternum of Pied Woodpecker.

\* AUDUBON, *Pic. erythrocephalus*.

† Prof. Owen found, in a single individual of the common Green

Woodpecker, two cæca of moderate size. In many that we have examined, these appendages were in variably wanting.—ED.



Others have cylindrical or much less angular bills, and smooth firm plumage,—the *Melanerpes*, Swainson, to which the well-known Red-headed Woodpecker of North America appertains. These are the most frugivorous of any, and sometimes feed on the eggs of other birds, even entering Pigeon-houses for that purpose. Their colours are disposed in large masses.

The Green Woodpeckers, or Poppinjays, (*Geococcyx*, Boié; *Chrysomitris*, Swainson,) constitute another subdivision, remarkable for the inner emargination of the sternum being much smaller than the outer, and for barred plumage in the young, which corresponds with the adult garb of certain species with slightly arcuated bills, that compose the *Colaptes*, Swainson: these two subdivisions are closely allied together, and the members of them frequently descend to feed at ant-hills, being exclusively insectivorous: there are two in Europe of the first, of which the common Green Woodpecker of Britain may be cited as an example, as the equally common Golden-winged Woodpecker of North America may be of the other. The species of both are remarkable for contorting the neck in the same manner as the Wrynecks.

Some additional subdivisions have been proposed, which are less admissible.]

#### THE WRYNECKS (*Yuncus*, Lin.)—

Have the tongue extensible, as in the Woodpeckers, and by the same mechanism, but without spines; their straight and pointed bill is somewhat rounder and less angular, and the tail is similarly composed, but broad, soft, and flexible [at the extremity, notwithstanding which the shafts are tolerably firm, and the bird leans on them when clinging]. They live pretty much as the Woodpeckers, except that they seldom climb, [and feed principally on Ants. Their flight is swift, and not undulating as in the Woodpeckers.

Two species only are known, one common in Europe as a summer visitant, appearing in Britain rather plentifully. Its size is that of a Lark, and colour elegantly pencilled brown and ash, resembling a lichenized branch. This bird arrives early in the spring, and is well known for its frequently reiterated cry, which resembles that of the smaller Falcons; it often repeats this note, holding on to a perpendicular twig. Instinctively trusting to the close resemblance of its tints to the situations on which it alights, it will lie close, and sometimes even suffer itself to be taken by the hand; or on such occasions will twirl its neck in the most extraordinary manner, rolling the eyes, and erecting the feathers on the crown and throat, occasionally raising the tail, and performing the most ludicrous movements; then, taking advantage of the surprise of the spectator, will suddenly dart off like an arrow. It breeds in the holes of trees, and lays several polished white eggs, resembling those of a Woodpecker.]

#### THE PICULETS (*Picumnus*, Tem.)—

Scarcely differ from the Wrynecks, except by a very short tail, [which is soft, and held elevated, like that of a Wren. Their beak and tongue are rather, however, those of a true Woodpecker, which they exactly resemble in their whole anatomy]. They are very small birds, and there is even one of them which is destitute of the small hind-toe.

#### THE CUCKOOS (*Cuculus*, Lin.)—

Have the beak of mean length, rather deeply cleft, compressed, and slightly arcuated; the tail long, [with ten feathers only]. They subsist on insects [and fruits], and are mostly migratory. [Have a lax stomach, cæca like those of the Owls, and no gall-bladder]. We subdivide this numerous group as follows.

#### THE TRUE CUCKOOS (*Cuculus*, Cuv.)—

Have the beak of medium strength, and short [partly feathered] tarsi. They are celebrated for the singular habit of depositing their eggs in the nests of insectivorous [as well as granivorous] birds; and, what is not less extraordinary, the foster-parents, often of species much inferior in size, bestow as much care on the young Cuckoo as upon their own proper nestlings, even although the deposition of the strange egg is preceded [or rather, (as we have ascertained,) succeeded, which is still more curious,] by the destruction of whatever others may have been in the nest: [or, if other eggs are subsequently laid, and hatched with the young Cuckoo, the latter is endowed with the astonishing instinct, about the eighth day, of ejecting its helpless companions by insinuating itself under them, and then by a jerk casting them successively over the rim of the nest]. The cause of this phenomenon, unique [so far as is known, with the exception of the *Molothra* (p. 202),] in the history of Birds, is yet unknown, [but appears, we conceive, to be immediately connected with the structure of the reproductive organs; and to be necessitated by the fact of the female Cuckoo requiring several days to intervene between the deposition of each successive egg, five or six in number, for which reason she could not well incubate her own: certain it is, however, that although a great proportion of the young Cuckoos are not hatched till after their parents have migrated southward, the female has been often seen to loiter about in the vicinity of her offspring, which she has been known to entice away when it



took flight]. Hesitant attributed the phenomenon to the position of the gizzard, which in fact is placed further backward in the abdomen, and is less protected by the sternum (fig. 101) than that of other birds [in general, but not of the Moth-hunters, which the Cuckoos closely resemble in their internal anatomy, and particularly in the singularly diminutive size of the brain: the young are exceedingly slow in learning to take their own food, and are fed by their foster parents till they have nearly attained the full growth of their feathers.

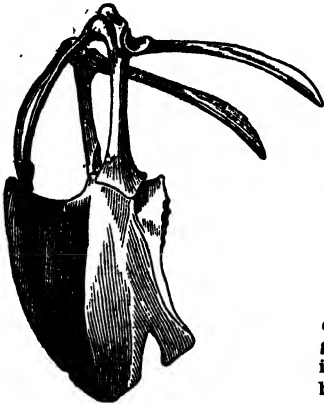


Fig. 101.—Sternum of Cuckoo.

Of various species, all peculiar to the eastern hemisphere,] there is one in Europe,

The Common Cuckoo (*C. canorus*, Lin.)—Of an ash-grey colour, the belly whitish, rayed with dusky black across, and tail-feathers laterally spotted with white: the young barred all over with rufous. [It feeds principally on caterpillars, and is sometimes seen to hawk for insects on the wing, also devours cherries and the smaller fruits. Is well known for its cry, which is common to both sexes, and is sometimes uttered on the wing; as is also another particularly melodious sound, which it generally emits as it takes flight; it often congregates many together on the same tree, attracted by each others' notes; but never flies in society, except when migrating. It does not pair; is particularly shy and retiring in disposition, and is often buffeted by the small birds on whose domain it encroaches.]

Africa [and the islands of the Indian Ocean] produce several small species, the plumage of which is more or less gilded, [or brilliant emerald-green, bronzed, or purple]. Their beak is rather more depressed than in the preceding, [and they compose the *Chalcites*, Swainson, which, however, are scarcely separable either from structure or habit].

A crested, spotted species is occasionally found in southern Europe, the cry of which is more sonorous (*C. glandarius*, Edwards). [This, with

various others from Africa, pertains to the distinct group *Oxylophus* of Swainson, which, with the following, has longer and naked tarsi.]

Others inhabit America [all of which build nests and rear their offspring, constituting the *Erythrophrys*, Swainson: these are well known to feed much on the eggs of other birds, which it is generally believed the true Cuckoos do also: some of them descend much on the ground, and prey on snails like a Thrush, in addition to berries and caterpillars. The young resemble the adults].

Others again, with generally spotted plumage, have the beak deep vertically.

#### THE COUAS (*Coccyzus*, Vieillot)—

Merely differ from the Cuckoos by their elevated tarsi. They nestle in the holes of trees, and do not entrust their eggs to the charge of strangers: this is at least true, with respect to those species of which the propagation is known.

There is one in America that requires to be distinguished,—

#### THE LIZARD-SEEKER (*Saurothera*, Vieillot),—

Which has a long beak, curved at the tip only, [and feet adapted for running swiftly on the ground, as is the case with the American Cuckoo tribe generally].

It is the *Cuculus vetula* of Temminck.

Le Vaillant has already separated, with good reason,

#### THE COUCALS (*Centropus*, Illiger),—

Birds of Africa and India, the thumb-nail of which is long and pointed as in the Larks, [and the plumage in general singularly rigid and spinous]. All the known species are natives of the eastern hemisphere, and nestle in the holes of trees, [producing white eggs. They feed chiefly on Grasshoppers, and run about with celerity among reeds and other herbage, from which they are slow to take wing: their flesh is particularly rank; and the eyelids are fringed with lashes, as in most of the Cuckoo tribe which rear their own offspring.

The species are very numerous, and grade into the true Couas and Malkohas].

The same naturalist has rightly separated

#### THE COUROLS (*Leptosomus*, Vieillot),—

Madagascar birds, the beak of which is thick, pointed, straight, and compressed, with the tip of the

upper mandible but slightly arcuated, and the nostrils pierced obliquely in the middle of each side of it. Their tail consists of twelve feathers; and they nestle in holes of trees like the preceding, and inhabit forests. It is said that they are principally frugivorous.

[They are closely related to the Puff-birds of America, and like them produce only two eggs, and have the first and fourth toes directed laterally, enabling them to perch lengthwise.]

#### THE HONEY-GUIDES (*Indicator*, Vieillot)—

Are birds of South Africa that feed on honey, and which are celebrated for guiding the natives to the nests of wild Bees, enticing them to the spot by flitting before them, and reiterating a peculiar cry; [they also, however, lead them in like manner to where a beast of prey lies concealed]. Their beak is short, high, and nearly conical, like that of a Sparrow. There are twelve tail-feathers; and the tail is at the same time wedge-shaped and a little forked. Their skin, singularly tough, protects them from the stings of Bees; which latter, however, continually tormenting them, sometimes kill them by attacking the eyes.

[These curious birds are most nearly allied to the Woodpeckers, and climb trees in the same manner, having similar feet and claws. Their colours are sombre, and, contrary to what occurs in all the Cuckoo tribe, there is a distinct accessory plume to their feathers. They lay several pure white eggs in the holes of trees, precisely like those of the Woodpeckers.]

#### THE BARBACOUS (*Monasa*, Vieillot)—

Have the beak conical, a little compressed, lengthened, slightly arcuated towards the tip, and armed at its base with stiff bristles or barbless plumes, which approximate them to the Barbets, [or rather to the Puff-birds, which the author ranges with the Barbets, like which they have also twelve tail-feathers, and the first and fourth toes directed laterally. The sternum resembles that of a Cuckoo, but with a small second emargination.

These birds have blackish plumage, and generally coral-red bills. Their habits are precisely the same as those of the Puff-birds, which they further resemble in laying two eggs in holes, and in being peculiar to America.]

#### THE MALKOHAS (*Phenicophæus*, Vieillot)—

Have a very thick bill, round at its base, and arched towards the tip, [somewhat as in the Toucans], with a great naked space round the eyes. Some have round nostrils, placed near the base of the bill, while in others they are narrow, and situate near its edges. They are natives of Ceylon [and other warm parts of the eastern hemisphere], and live, it is said, principally on fruits.

Certain species of them should probably be distinguished, that have the beak less thick, and no bare space round the eyes.

#### THE RAIN-FOWL (*Scythrops*, Latham)—

Have the beak still longer and thicker than in the Malkohas, and furrowed on each side with two shallow longitudinal grooves: their nostrils are round, and the space surrounding the eyes naked. The beak approaches that of the Toucans [in its superficies only], but the tongue is not ciliated as in those birds.

Only one is known, the Australian Rain-fowl (*Scr. australasia*, Shaw), a grey bird of the size of a Crow, whitish and a little barred underneath. [Its sternal apparatus and digestive organs resemble those of the European Cuckoo, as do also its system of coloration, and the structure of its feathers. Mode of propagation unknown].

#### THE BARBETS (*Bucco*, Lin.)—

Have a thick conical beak, bulged on the sides of its base, with five overlying bundles of stiff bristles directed forwards; one behind each nostril, another on each side of the base of the lower mandible, and the fifth placed at its symphysis. Their wings are short, and their proportions and flight rather heavy. They subsist on insects, and attack smaller birds; occasionally feeding on fruit: nestle in the holes of trees.

They require to be divided into three subgenera.

#### THE BARBICANS (*Pogonias*, Illiger)—

Have one or two strong denticulations on each side of the upper mandible, the ridge of which is arcuated and obtuse, [and the sides marked with transverse grooves]. Their bristles are very stout. They inhabit Africa and India, and feed more on fruit than the others.

[The species are not numerous, and are generally black variegated with crimson. The compressive force of their beak is very considerable; and they seldom climb.]

### THE RESTRICTED BARBETS (*Bucco*, Cuv.)—

Have the beak simply conical, slightly compressed, with a blunt ridge, a little raised about the middle. They are found in both continents, and are generally adorned with vivid colours. At the season of propagation they are found in pairs, and in little troops [or families] during the remainder of the year.

[This and the preceding subdivision form a totally distinct group from the rest, and are most nearly related to the Woodpeckers: the tongue, however, is of the ordinary structure, and they have but ten tail-feathers, which are not rigid. Their feet also are adapted for descending the trunks of trees, like a Nuthatch, and not merely for ascending them, as in the Woodpeckers and Tree-creepers; having the claw of the reversed toe particularly hooked and sharp. The beak is especially fitted for cutting the stems of fruits, as with a pair of scissors; and they lay always four white eggs in the holes of trees, occasionally resorting to the composite nests of the social Grosbeaks. Some other divisions have been instituted among them, with propriety; and they altogether constitute a natural family, some species of which are even entirely destitute of the tufts of bristles, which latter may be traced, in various degrees of development, in many other birds, as the Trogons, &c.]

### THE PUFF-BIRDS (*Tamatia*, Cuv.)—

Have the beak rather more elongated and compressed, with the extremity of the upper mandible [generally] bent downward. Their disproportionately large head, great beak, and short tail, impart an air of stupidity, [which is less observable in the ordinary aspect of the living bird, the dense plumage of which is commonly puffed out into a round ball]. All the known species inhabit America, and subsist on insects.

[They are generally subdivided into *Tamatia* proper, the beak of which somewhat approximates that of the Bush-shrikes, and *Lyporhiza*, in which it is smaller, little if at all hooked at the tip, and grading towards that of the Barbacous. Together with the latter genus, and the Courols of Madagascar, they form a distinct group, most nearly related to the Cuckoos, which they resemble anatomically; all the members of which appear to possess the habit of puffing out their feathers, and perch lengthwise, clasping the bough with their first and fourth toes, which are directed sideways and not backwards, the same as in the Touracos: they have all twelve tail-feathers, and invariably lay two eggs, in holes either of trees or banks, which probably produce male and female that associate for life, as they are constantly observed in pairs. The American species appear to differ in being exclusively insectivorous, watching for the larger insects, which they take in the manner of a Flycatcher: their manners are familiar; and the plumage of the forehead directed forwards and more or less terminating in stiff points, very rigid to the feel, which admirably defend the eyes from the fluttering of their insect-prey. The colours of all are sombre, and not gay, as in the Barbets].

### THE TROGONS (*Trogon*, Lin.)—

Together with the bundles of bristles round the bill of the Barbets, have a short beak, broader than high, curved at its base, with a blunt arcuated ridge to the upper mandible. Their small feet, feathered nearly to the toes, their long and broad tail, and fine, light and dense plumage, impart a peculiar air. Some portion of their plumage has generally a brilliant metallic lustre; the rest being vividly coloured. They nestle in the holes of trees [producing two or four delicate rounded white eggs, the shell of which is particularly slight and fragile], subsist on insects, and frequent low branches in the interior of thick woods, flying only during the morning and evening.

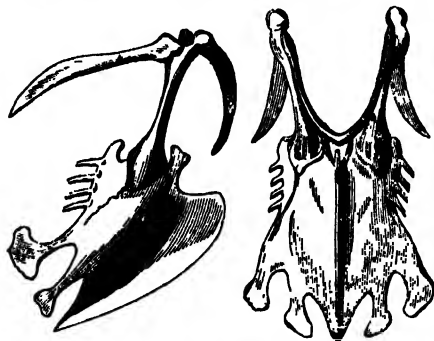


Fig. 102.—Sternum of Trogon.

[The Trogons constitute another distinct and insulated group, intermediate in some respects to the Cuckoos and Moth-hunters, both which they resemble generally in their anatomy, but are hatched naked, in which they differ from either. The sternum (fig. 102) is doubly emarginated. Their toes are remarkable for being zygodactyle on a different principle from that of any other genus; the ordinary inner toe being reversed instead of the outer one: their feathers closely resemble in structure those of the true Poultry, and are similarly elongated over the rump, where in certain species they attain an extraordinary development in the male sex, analogous to the train of a Peacock. Like the Poultry, also, they are remarkable for the small proportional size of the head. They capture insects in the manner of a Flycatcher, with a swift and deeply undulating flight; some of them feeding likewise upon berries. Are found in the warm regions of both continents.]

### THE ANI (*Crotophaga*, Lin.)—

Are known by their thick, arcuated, and compressed beak, without denticulation, high, and surmounted

by a sharp vertical crest [like that of several of the smaller Hornbills]. They are birds of the hot and humid climates of America, with stout and elevated tarai, a long and rounded tail [composed of only eight feathers], and black plumage. They subsist on insects and grain, fly in flocks, and several pair lay and incubate in the same nest, which is placed on the branches of trees, and is built of a size proportionate to the number of couples which help to construct it. They are easily tamed, and even taught to speak; but their flesh is rank and disagreeable.

[The similarity of the colour and size of these birds to the *Quiscalis* and *Scolecophagi*, (p. 202), which inhabit the same countries, has occasioned much confusion in their history. It is the latter, and not the Ani, which are granivorous; and which also are easily tamed and taught to speak, the Ani having no accessory vocal muscles, and consequently only uttering a particular screech. The name *Crotophaga* implies that they feed on the insect parasites of cattle, like the common Starling; which is not true of the Ani, though it applies to the birds with which they have been confounded. The Ani strictly appertain to the Cuckoo group, and are remarkable for possessing eyelashes like the Coucals and Hornbills: though inhabitants of the hottest regions of America, they are remarkably solicitous for warmth, and soon perish of the least chill; hence their singular sociality even while brooding on their eggs, which are of a dark green colour. Several species are now known, and they appear to subsist exclusively on insects.]

#### THE TOUCANS (*Rhamphastos*, Lin.)—

Are at once recognized by the enormous size of the bill, which is nearly as large and as long as the body itself, but internally very light and cellular, [or rather permeated by a fragile network of osseous fibres], having its edges dentated, and both mandibles arched towards the tip; the tongue is narrow and elongated, and laterally barbed like a feather. They are peculiar to the warm regions of America, where they live in small troops, [different species of them commonly associating in the same flock], and subsist on fruit and insects, and during the nesting season on the eggs and young of other birds. The structure of the bill necessitates them to throw each morsel of food into the air, and catch it in the throat; [a habit practised by many other birds in which the tongue is either unusually short, or of a form unfit to assist in deglutition]. Their feet are short [not particularly so]; their wings but moderate, and tail rather lengthened, [and commonly held erect; it consists of ten feathers]. They nestle in the trunks of trees [producing, in every known instance, two delicately white eggs, of a rotund form: the young recurve their tails upon the back while in the nest.

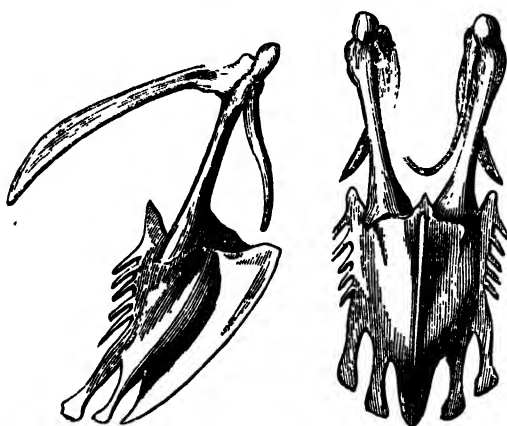


Fig. 103. —Sternum of Aricari.

These birds have a doubly emarginated sternum of peculiar form (fig. 103), a slightly muscular stomach, and short intestines without cæca: they have no gall-bladder. Their movements are light and elegant in an extreme degree, leaping from bough to bough with the most lightsome agility, so that, in the living bird, the beak has no appearance whatever of being disproportionately large. They fly rapidly, but evidently with much exertion, and with difficulty against the wind, raising the bill above the axis of the body, and propelling themselves at short intervals: are exceedingly destructive to the eggs and young of other birds, which they frequently obtain by dipping their huge bill into the deep pensile nests which abound in their indigenous abode, that organ being remarkably sensitive, which enables them to feel the contents. When roosting at night, they contrive to bury their enormous beak completely between the scapular and interscapular feathers; and they employ it with singular dexterity, and are often observed to scratch it

gently with the foot, as if that produced an agreeable sensation: many nervous papillæ are distributed over its surface].

#### THE RESTRICTED TOUCANS—

Have the beak thicker than the head, and are generally black, with vivid colours on the throat, breast, and croup. [Their size is comparatively large, both sexes are alike in plumage, the tail is less cuneated, the clavicle bones are separate, short, and pointed, not joined to constitute a *furcula*, as in Birds in general.]

#### THE ARICARIS (*Pteroglossus*, Illiger)—

Have the beak not so thick as the head, and enveloped with a less attenuated corneous covering; their

size is inferior, and the ground-tint of their plumage commonly green, with some red or yellow on the throat and breast; [the female is chestnut-brown where the male is black, the tail much graduated, and the female (fig. 103) complete.

Among the Aricaris are certain species more vividly green than the rest, the beak of which has a deep, lateral, longitudinal furrow; they are the Groove-bills (*Adacorynchus*, Gould). The Aricaris generally are more variegated than the true Toucans, to which they bear nearly the same relationship which the Jays and Magpies hold with the Crows. They appear to be less carnivorous].

#### THE PARROTS (*Psittacus*, Lin.)—

Have a stout, hard, solid beak, rounded on all sides, and enveloped at base by a membrane in which the nostrils are pierced; together with a thick, fleshy, and rounded tongue: two circumstances which impart the greatest facility in imitating the human voice. Their inferior larynx, which is complicated, and furnished on each side with three peculiar muscles, [the bony ring at the divarication of the bronchi being besides incomplete, so as to permit of dilatation and contraction,] further contributes to the same object, [if, indeed, it be not entirely produced by the latter means]. Their vigorous jaws are set in motion by a greater number of muscles than are found in other birds, [whence especially results the remarkable mobility of the upper mandible]. They have very long [and remarkably slender] intestines, without cæca; and subsist on fruit of all kinds [together with bulbs and other succulent parts of vegetables in many instances, holding their food up to the mouth with one foot, as with a hand]. Assisted by their hooked bill, they clamber about the branches of trees; nestle in hollow trunks; and have a loud and harsh voice in a state of nature. Nearly all of them are adorned with gorgeous colours, and they are scarcely found out of the torrid zone, [except in the southern hemisphere], but are found in both continents, the species of course differing in each. Every large island even has its own species, the short wings of [many of] these birds incapacitating them from traversing great tracts of sea. The species are therefore extremely numerous, and are subdivided according to the form of the tail and some other characters.

[This extensive group is obviously an ordinal division of the class, and should doubtless rank first in the series of Birds, preceding the Birds of Prey, as among Mammalia the *Quadrumanæ* do the *Carnivora*. If we except the trivial character of their outer toe being reversed,—and their foot even is in all other respects extremely different, and covered with small tubercle-like scales, instead of plates as in all the *Passerina*, and the rest of the yoke-footed genera without exception,—they have absolutely nothing in common with the other *Zygodactyli* that should entitle them to range in the same special division: their whole structure is widely at variance; and if there be one group more than another to which they manifest any particular affinity, it is that of the diurnal Birds of Prey, which we conceive should range next to them, though still very distantly allied. They certainly accord with the Falcons more than with any other bird in the contour of the beak, and the nostrils are analogously pierced in a membrane termed the *cere*: they have a similar enlargement of the oesophagus, which occurs in no other zygodactyle



Fig. 104.—Sternum of Parrot.

bird, but which is glandular as in the Pigeons, secreting a lacteal substance with which the young are at first nourished, (the Parrots and Pigeons being almost the only birds which subsist exclusively on vegetable diet at all ages). The stomach is but slightly muscular, and we have found it enormously enlarged in old cage specimens; intestines singularly long and slender, as before stated; and there is no gall-bladder, a particular in which the Parrots accord with the Toucans, the great Cuckoo group, and that of the Pigeons. The sternal apparatus (figs. 104 and 105) differs least from that of the diurnal Birds of Prey, the medial ridge being however rounded anteriorly, and the furcula slight and peculiarly flattened, being least unlike that of the Pigeons, while in one subdivision of Parroquets it is absent altogether. From the rest of the zygodactyle birds, the Parrots differ remarkably in their intelligence and docility, qualities in which some species are unsurpassed by any member of the class; while the other tree birds not framed on the definite type of the *Passerina*, are with few exceptions remarkably devoid of intelligence, and incapable of receiving instruction.

It may further be noticed, that all the numerous tribe of Parrots conform in every essential detail of their organization, being framed on an especial subtype, which, however it may admit (like every other) of subordinate modifications, exhibits no indication of a passage or transition into any other form: the same remark applies to several of the preceding groups that do not pertain to the *Passerina*, but which are lower in the scale than the present one, or, in other words, less distantly removed apart than all are from the latter; that they have not been generally recognized as thus insulated, which all have acknowledged to be the case in the instance of the Parrots, is attributable to their equally constant distinctive characters being less obvious externally.

The Parrots have been arranged under many named subdivisions, the limits of which are mostly arbitrary, though several very natural groups are tolerably distinct.

First, among the species with square tails, we may notice the great Black Cockatoos of Australia (*Calyptrornis*, Vig.), large crested species, with beak of extraordinary strength, and very deep vertically. Their plumage is black, with some red or yellow on the tail; wings capable of vigorous flight; and food the seeds of the *Eucalypti*, with the juice of which fruit their bills are generally stained. Attempts to maintain them in captivity appear to have always hitherto failed. The subdivision *Corydon*, Wagleri, is barely separable.

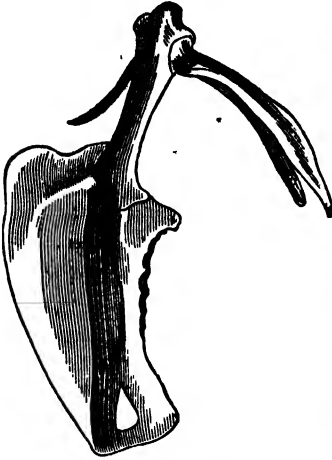


Fig. 106.—Sternum of Parrot.

The White Cockatoos (*Phylolophus*, Vieillot), the species of which inhabit the Indian Archipelago and Australia, fall into two minor groups according to the form of the crest. Their disposition is singularly gentle and affectionate, and several species are abundantly brought alive to Europe, where they are kept with much facility. Their singular antics and extraordinary grotesque movements are well known to all.

The square-tailed species without crests constitute the restricted Parrots (*Psittacus*) of several authors, and are found in the old and new continents. They are generally esteemed for the facility with which they learn to speak; and the majority are gaily coloured: it is necessary, however, to subdivide them much further. One group, termed *Nestor*, is remarkable for the extraordinary elongation of the upper mandible, which far overhangs the lower: it is believed to be employed in hooking up bulbs: the members of this division are essentially crestless Cockatoos, allied to *Pl. nasicus*, and are also natives of Australia.

The Love-birds (*Psittacula*, Kuhl), compose a beautiful group of species of diminutive size, wherein the tail is slightly graduated; they are found in both continents, and are remarkable for having no furcula.

The Ring Parroquets (*Palæornis*, Vig.), have a very long pointed tail, and collar-like mark round the neck; they inhabit the Asiatic

continent and islands, where there are many species.

Australia produces numerous long-tailed Parroquets with more elongated tarsi, adapted for running on the ground; their tail-feathers are not pointed, and their colours are in general gorgeously variegated, and peculiarly mottled on the back. They constitute the *Platycercus*, Vig. and Horsf. *Polytelus*, Wagler, is allied, with pointed tail-feathers; and *Nymphicus* refers to a small species related to the latter, but with the pointed crest of some Cockatoos.

The Macaws (*Ara*, Kuhl; *Macrocerus*, Vieillot), are long-tailed American species, which exceed all the rest in size, and are superbly coloured. The more characteristic have a large space of naked skin on the cheek, crossed by narrow stripes of short feathers. This bare space is gradually lost as they successively decrease in size, and they finally grade into the American Parroquets (*Conurus*, Kuhl), one species of which (*Ps. carolinensis*, Auct.) is the only member of the Parrot group found northward of the tropic of Cancer.

The Lories (*Lorius*, Vieillot),—are oriental species with square tails, and dense soft plumage, the colours of which are glowing in the utmost degree: beak in general comparatively feeble. Some allied birds are smaller, and have graduated tails, but are particularly distinguished by their extensible tongue having a circle of papillæ at the tip, adapting them to feed on the nectar of flowers: they are termed Lorikeets (*Trichoglossus*, Vigors). *Tanygnathus*, Wagler, includes some Lories with immense bills; and *Coryphæus*, a number of small species, with slender bills, thick skin, and commonly purple colouring. Finally, *Pezoporus*, Illiger, and *Nanodes*, Vig. and Horsf., consist of some beautiful and delicate long-tailed species, which have also feeble bills, and tarsi somewhat elevated; they are known to seek their food chiefly on the ground.\*

Among the Climbers are commonly placed two nearly allied African genera, which appear to me to have also some analogy with the *Gallinacæ*, and with the Curassows in particular. They have the wings and tail of the latter, [their tail, however, consisting of only ten feathers, instead of fourteen], and like them inhabit trees; their beak is short, and superior mandible bulged, [or compressed and much elevated; the gape remarkably wide]; the feet have a short membrane which connects the external and front toes, though it is true that the outer toe is often directed backward, as observable in the Owls. Their nostrils are simply pierced in the corneous substance of the beak, the cutting edges of the mandibles are denticulated, and the sternum (fig. 106), at least that of the Touraco, has not those two very deep emarginations common to the *Gallinacæ*.

[Here we have another insulated group, which also comprises the Colies (p. 201), the anatomy of

\* We would enumerate some additional subdivisions, but their distinctive characters could not be given with the requisite brevity.

which at once indicates the propriety of arranging it in the present series, among which it is most nearly related to the Toucans. They have but twelve true cervical vertebræ; and the sternum, though singularly small, presents no affinity for that of the Poultry. The stomach is large and but slightly muscular, extending into the abdominal portion of the cavity of the body; and the intestines are short and without cæca. Unlike the Toucans, however, they possess a small gall-bladder; but the tongue, at least in some of them, is similarly barbed towards the tip. The feet have the first and fourth toes directed laterally, for which reason they commonly perch lengthwise on the horizontal branches of trees, which they perambulate longitudinally, clasping the bough with their two laterally disposed toes, while the others are directed forwards. Their movements are light and elegant in the extreme, a particular in which they differ remarkably from the Colies: they pass with an easy sailing flight from tree to tree; live in pairs or families according to the season; subsist almost exclusively upon fruits, and lay four delicate white eggs in the hollows of decayed timber].

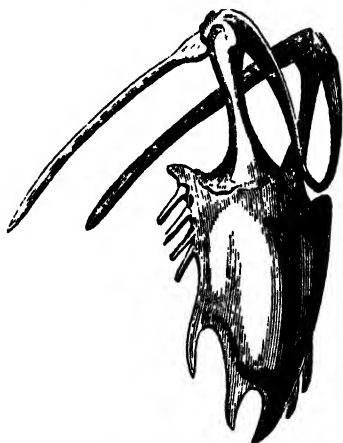


Fig. 106.—Sternum of Toucan.

Such are

#### THE TOURACOS (*Corythæx*, Illiger),—

The beak of which does not ascend upon the forehead, [and is generally much compressed], and the head is adorned with an erectile crest.

[Seven species are now known, the ground-colour of which is generally vivid-green, with some gorgeous crimson on the open wing. We should observe, that in all this group the feathers are very short upon the rump, being the reverse of what obtains throughout the Poultry. The head, however, is small, as in the latter.]

#### THE PLANTAIN-EATERS (*Musophaga*, Isert),—

Are so named from the fruit on which they subsist, and are characterized by the base of the bill forming a disk, which covers part of the forehead.

[They grade, however, into the former, the beak becoming more and more inflated, till in one species it forcibly recalls to mind that of a Toucan. Another is of great size, approaching the stature of a Curassow, and has a splendid curled crest, resembling that of several of those birds.

A third genus consists of

#### THE NAPE-CRESTS (*Chizæris*, Swainson),—

Which have a rounded beak approaching that of some Trogons, and hard and sombre mottled plumage, very unlike that of the others. Their exterior toe is more limited in its range outward by the connecting membrane.

Two species are well known, both from Africa, like all the preceding,—one the *Phasianus Africanus* of Latham.

We here, at length, arrive at a sufficiently marked interruption of the series of the class of Birds, to be enabled to introduce some remarks on the affinities of the preceding orders, which we conceive might be arranged most naturally as follow.

I. SCANSORES, as limited to the Parrots.

II. RAPTORES, or the Birds of Prey; which subdivide into two thoroughly distinct sections.

III. STREPTORES, *Screechers*, consisting of all the remainder that are not organized upon the definite type of the *Passerina*. It is necessary to subdivide them first into three series, which might be designated *Syndactyli*, *Zygodactyli*, and *Heterodactyli*; the two first of which names, however, do not rigidly apply in every instance, the groups being founded rather upon the aggregate of the organization, than upon any single character.

1. *Syndactyli*.—These, with the exception of the *Motmots*, are exclusively animal-feeders, like the *Raptores*, to which they succeed; and even the *Motmots* subsist more upon animal than upon vegetable diet. They fall under two principal minor groups, which we term *Bucconoides* and *Halcyonoides*.



The *Buceroidea* are distinguished by a very short and heart-shaped tongue, a singly-emarinated sternum, and ten tail-feathers only; intestines short, and we believe always without cæca; plumage never vividly coloured. In order to mark the degree of value of the two very distinct genera included, we conceive it necessary to indicate the Hornbills by the term *Appendiostres*, and the Hoopoes by that of *Arculirostres*. Both are peculiar to the eastern hemisphere.

The *Halcyonidae* have a doubly-emarinated sternum, twelve tail-feathers, and, with the sole exception of one group of Kingfishers, splendidly coloured plumage. They fall into three tribes, viz., *Cylindrirostridae*, comprising the Rollers, Bee-eaters, and Kingfishers, which have tongues similar to the foregoing, membranaceous stomachs, and no cæca; a thick skin, firm plumage (not moulted the first year), and great power of wing; nidificating in holes, and producing numerous shining white eggs, &c.;—*Angulirostres*, composed of the Jacamars and Todies, which have thin, lengthened, lamina-like tongues, muscular gizzards, and great cæca, resembling those of the Owls; thin skin, soft plumage, feeble powers of flight, and which produce coloured or speckled eggs, also in holes;—and *Serratirostridae*, or the Motmots, which are intermediate to the *Cylindrirostridae* and the Toucans, (which commence the next series). The *Angulirostres* and *Serratirostridae* are confined in their distribution to America; while the *Cylindrirostridae*, with the exception of a single subdivision of Kingfishers partly, are found only in the old world.

2. *Zygodactyli*.—The members of this division likewise fall into two principal minor groups, which may be termed *Picoides* and *Cuculoides*. The greater number subsist on mixed diet, and a marked predatory propensity is retained by some.

The *Picoides* have always (at least in every known instance) a doubly-emarinated sternum, comparatively muscular gizzard, and no cæca to the intestine. They all produce white eggs, less spherical than those of the *Syndactyli*, (in which respect the latter approximate the *Raptore*, which precede them); and have an accessory plume to their feathers, more or less developed; their plumage being almost always adorned with vivid colours. It is in this group that the tongue is so variously modified, in the Toucans, Woodpeckers, &c. To bring the species as near as possible together, they may be arranged into two tribes, viz., *Levirostridae*, consisting of two very distinct families,—that of the Toucans, and that of the Touracos and Colies; and *Cuneirostres*, comprehending the Woodpecker family (which includes the Honeyguides), and that of the Barbets. The Toucan and Touraco families are respectively peculiar to the old and new worlds, the latter, with the sole exception of two or three Colies, to Africa; the Woodpeckers are generally diffused, excepting in Australia; and members of the Barbet family are found in the warm regions of both hemispheres.

The *Cuculoides* have a comparatively lax stomach, and invariably great cæca, which whenever they occur throughout the *Streptopores* are always of the same proportional dimensions and form as those of the nocturnal Birds of Prey: their colours, excepting in one group of Cuckoos, are never bright; and they have no trace of an accessory plume to the feathers: the greater number lay coloured or speckled eggs, and many construct inartificial nests in bushes, (all the preceding genera, save the Colies only, resorting to holes for that purpose). A great proportion of them have the outer and middle toes more or less directed laterally. They fall under two families only, that of the Courols, Barbacous, and Puff-birds, which have twelve tail-feathers, and that of the Cuckoos, which have only ten or fewer, and which might be again naturally distributed into several supergeneric divisions, or subfamilies. Of these, we can only remark, that that which comprises the parasitic species is peculiar to the old world.

3. *Heterodactyli*.—This group consists of Birds the great majority of which are mainly insectivorous, and take their food on the wing. They are generally endowed, therefore, with considerable power of flight, have a wide gape, and short feet, rarely adapted for progression. The only *zygodactyle* family of them has the toes differently disposed from those of all other



yoke-footed genera. The species which possess cœca closely accord with the *Cuculoides* in their anatomy, but all of them possess the accessory plume to the clothing feathers, in which they differ from that group. We subdivide them into *Trogonoides* and *Cypseloides*.

The *Trogonoides* consisting of the Trogons only, it will be sufficient to refer to the generic head (p. 216). They have twelve tail-feathers.

The *Cypseloides* have only ten. They divide into two tribes, which may be termed *Parvirostræ*, containing the family of Podargues and Moth-hunters, nocturnal species with great cœca, and which lay mottled eggs; and *Tenuirostræ*, comprising the two distinct families of the Swifts and Humming-birds, which have no cœca, and lay white eggs, the last-named family differing remarkably from all the preceding *Streptitres* in having a complicated inferior larynx, which character obtains throughout the next order, without a single known exception.

Although the foregoing long series of groups, more or less subordinate, evince a decided mutual affinity and tolerably regular successionship, to those who have practically studied them, we have been unable to detect a single character that will apply to all, and the only one which approximates to being general, consists in the lower larynx being provided with only the sterno-tracheal pair of muscles, save in the single family of the Humming-birds: hence these birds are unable to inflect the voice, and *sing*; and they are generally very inferior in intelligence and docility to the members of either of the three other orders with which we are now engaged; the *Picoides* and Hoopoes constituting the chief exceptions to this generalization. Linnæus obtained a glimpse of their distinctness from the *Passerinæ*, when he instituted his ordinal divisions *Picæ* and *Passeres*; but he fell into error in assigning a position among the former to the Crows, which alone could have induced Cuvier to remark that he could discover no distinctive character to separate the *Picæ* and *Passeres* of his great predecessor.

The series of *Streptitres* can accordingly be defined only by negative characters, derived principally from comparison of them with the *Passerinæ*. Perhaps the most remarkable fact connected with their anatomy, consists in the cœca being invariably either altogether absent, or, if present, developed to a considerable but fixed size, which never varies; this diversity being found to exist in groups that are nearly allied, as in the Swifts and Moth-hunters, the Kingfishers and Todies, &c.

IV. CANTORES, or the restricted *Passerinæ*.—It is impossible for a greater contrast to be afforded than is furnished by this ordinal division and the preceding one. Although comprising many more species and received generic divisions than the three foregoing orders collectively, there is absolutely no essential difference of structure perceptible throughout the whole immense series; the only differences consisting in the degrees of developement of parts common to all: the peculiar type of skeleton, digestive and vocal organs, &c. being invariably one and the same, just as the Humming-bird or Parrot model is analogously varied, in a minor degree. There are no subdivisions equivalent to those which have been indicated as families even of the *Streptitres*, however the beak may vary in magnitude and form; the most dissimilar beaks being often unaccompanied by other marked diversities, so that a dead specimen deprived of its head, although at the first glance it might be referred with certainty to the present order, could only in a few instances be assigned, even on anatomical examination, to any particular group of it, and the plumage and style of colouring would even then afford the surest indication of its affinities, in the great majority of cases. In the *Streptitres*, on the contrary, any one organ, and very commonly a single ordinary clothing feather, would suffice to indicate the very genus from which it had been taken: the varieties in the form of the sternal apparatus may be cited as one illustration of the considerable diversities observable in the whole structure of the *Streptitres*; whereas a single sternal apparatus (fig. 86, p. 178), we have deemed fully adequate to represent the form of this important portion of the skeleton throughout the amazingly extensive series of the present division.\* There are, in fact, no

\* The sternal apparatus of numerous genera of Cantores are beautifully figured in Mr. Yarrell's *History of British Birds*.

characters of dichotomous application, till we descend to minute particulars, such as the seasonal and progressive changes of plumage, the system of coloration, character of the eggs, &c. ; and these require to be carefully and extensively studied, in order to extricate the *Cantores* from their present heterogeneous state of artificial arrangement, which, like most other classifications based on the variations of a single organ (the beak), has induced a variety of approximations at variance with natural affinity. To detail our own views on the arrangement of this great order, would require more space than the nature of the present work would allow; it must suffice, therefore, to refer to the few hints which have been given in the

of the various genera.

orders here indicated have a vague general character in common, which is not define or even express: it partially consists in the magnitude of the head, as compared the subsequent divisions generally; and a hind toe being always present, on the same plane with those in front, the great majority of them *perch* and traverse the boughs of trees with comparative facility, while the remainder are too obviously allied to admit of separation].

## THE FOURTH ORDER OF BIRDS,—

### THE POULTRY, (GALLINÆ, Lf.)—

Are so named from their affinity to the Domestic Cock, in common with which they have generally the upper mandible vaulted, the nostrils pierced in a large membranous space at the base of the beak, and covered by a cartilaginous scale. Their heavy carriage, short wings, and bony sternum (fig. 107), diminished by two emarginations so wide and deep that they

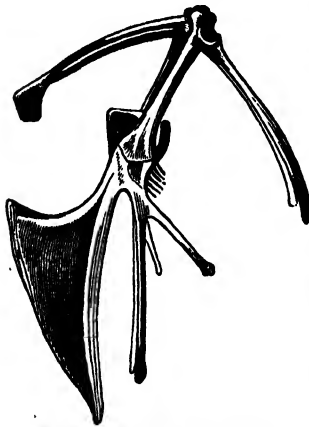


Fig. 107.—Sternum of Red Partridge.

occupy nearly its whole lateral portion, its crest being obliquely truncated in front, so that the sharp edge of [an appendage to] the fourchette is only joined to it by ligament, are circumstances which, by greatly impairing the force of the pectoral muscles, render their flight laborious. The tail has generally fourteen, and sometimes eighteen, quill-feathers. Their inferior larynx is very simple, so that none of them can sing. They have an extremely muscular gizzard, and [most generally] a large [globular] crop. If we except the Curassows, they lay and incubate on the ground, on a few carelessly arranged stems of straw or grass. Each male has ordinarily several females, and takes no sort of trouble either with the nest or young ones, which are generally very numerous, and, in most cases, are able to run as soon as they quit the shell.

[We should observe, that exceptions occur to almost all these generalizations in the course of the series, which will be pointed out as they arise. In the polygamous species, the male is always larger and more gaily coloured than the female; while in such as are monogamous, (as Ptarmigan and Partridges,) the sexes nearly or quite resemble, both in size and colour. This diversity is apparent in some species that are otherwise closely allied together. The head is very small, as compared with the members of the preceding orders generally; and the number of cervical vertebrae is irregular and always greater.]

The Poultry constitute, for the most part, a very natural family, remarkable for having furnished us with the greater number of our farm-yard fowls, and with much excellent game. Their anterior toes are connected at base by a short membrane, the edges of which are dente-

lated; and they can only be subdivided upon characters of trivial import, drawn from some of the appendages of the head. In order to avoid, however, an excessive multiplication of groups, we associate with them certain genera the toes of which have no connecting membrane, and one (that of the Pigeons) which links the Poultry with the *Passerinae*, the others (such as the Hoazin) presenting a slight approach to the Touracos; [very slight and superficial in both instances].

#### THE CURASSOWS (*Alector*, Merrem)—

Are large Poultry-birds of South America, which somewhat resemble Turkeys, and have a broad and rounded tail, composed of large stiff quills, [fourteen in number]. Several of them possess a singular conformation of the trachea. They live in the woods, feed on buds and fruit, perch and nestle upon trees, [their hind-toe being on the same plane with those in front], and are very sociable and easily domesticated. [The sternum has its inner emargination less deep than in other Poultry]. Gmelin and Latham have divided them into Curassows and Guans, but upon very indeterminate characters. We subdivide them in the following manner:—

#### THE CURASSOWS, properly so called, (*Crax*, Lin.).—

Have a strong beak, its base surrounded by a skin, sometimes brightly coloured, in which the nostrils are pierced; and their head is adorned with a crest of long, erectible, narrow feathers, curled at the tips. Their size is that of a Turkey, and like the members of that genus they fly up into trees. They are bred in a domestic state in America, and individuals have been received from that country so variously coloured, that we hesitate about characterizing the species.

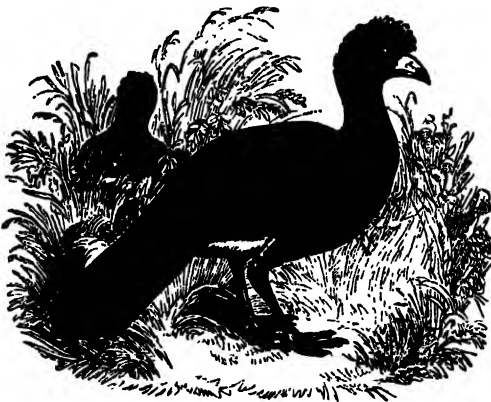


Fig. 108.—The Yellow-billed Curassow.

The most common, or the Yellow-billed Curassow (*Cr. alector*, Lin.), is black, with a white belly, and cere of the beak brilliant yellow. The trachea makes but one slight curve before it enters the breast. Some, as *Cr. globicera*, Lin., have a larger or smaller globular tubercle at the base of the beak.

#### THE PAUXI (*Ouarax*, Cuv.).—

Have a shorter and thicker bill, and the membrane at its base, as well as the greater part of their head, is covered with short dense plumage resembling velvet.

The most common of them, or the Galeated Pauxi (*Cr. pauxi*, Lin.), has an oval tubercle at the base of the beak, of a light blue colour and stony hardness, almost as large as the head. This bird is black, with the lower part of the belly, and tip of tail, white. It nestles on the ground, and its native country is not known with precision.

The trachea descends on the right side beneath the skin to behind the sternum, where it turns to the left, and ascends to enter the thorax through the fourchette: its rings are all compressed. Another species (*Cr. galeata*, Lath.; *Cr. tomentosa*, Spix), has a red salient crest on the beak, instead of the tubercle.

#### THE GUANS (*Penelope*, Merrem)—

Have a more slender beak than the others, and the space around the eyes naked, as is also the throat, which is mostly susceptible of inflation.

So many varieties of colour are found among them, that it is difficult to trace the limits of the various species. Those especially which have a crest, are extremely variable. [The size is in general much less than in the others, and form more slender: the naked parts are often beautifully coloured]. The trachea, at least in the crested species, descends under the skin far behind the posterior edge of the sternum, ascends, is again flexed, and then continues its course towards the fourchette, through which, as usual, it gains access to the lungs. In one crestless species (*Pen. marall*, Tem.), greenish-black, with a fulvous belly, (which appears very distinct,) the trachea forms in both sexes a curve at the upper part of the sternum, before it enters the lungs.

#### THE PARRAQUAS (*Ortalia*, Merrem)—

Merely differ from the Guans in having no naked skin about the head.

One species only is known, of a bronzed brown above, whitish gray beneath, and rufous on the head, (the *Ca-*

*traca*, Buffon; *Phasianus motmot*, Gmelin; *Ph. parraqua*, Lath). The cry of this bird is very loud, and articulates its name. The trachea of the male descends beneath the skin as low as the abdomen, and then ascends to enter the thorax.

With these different Curassows has been generally associated

THE HOAZIN (*Opiathocomus*, Hofmansegg).—

An American bird, which has the same port, and a short and thick bill, with nostrils pierced in its corneous substance, without any membrane. The head is adorned with an occipital crest of long feathers, very narrow and thinly barbed; and what distinguishes it from all the true Poultry, is the total absence of membrane between the toes.

This bird is the *Phasianus cristatus*, Lin.; of a greenish-brown, variegated with white above, the front of the neck and tip of the tail fulvous, and the belly chestnut. It is found in Guiana, perching along the margin of inundated places, where it subsists on leaves and the seeds of a species of *Arum*. Its flesh smells strongly of castor, and is only employed as a bait for particular fishes. It forms a genus very distinct from any other among the Poultry, and when its anatomy is known, may become the type of a particular family.

[This very curious bird is perhaps the most insulated species of the whole class: its eyelashes, and reticulated tarsi, help to separate it externally from the Poultry; and its anatomy is altogether unique, exhibiting a peculiar adaptation for deriving nutriment exclusively from foliage. The crop, of enormous dimensions, hollows out, as it were, the pectoral muscles and anterior portion of the sternal keel, occupying a great heart-shaped cavity, and extending backward half-way along the trunk and at least four-fifths the length of the sternal apparatus; it receives the superior portion of the œsophagus on the left side, and on the right is succeeded by an inflated canal, five inches and a half long, constricted like the human colon; and terminated by the proventriculus, to which follows the gizzard, which latter is no bigger than an olive, with its muscular coat scarcely thickened; the intestines are moderately long, and cœca an inch. The sternal crest, so deeply cut away in front, forms a slight ridge anteriorly, which is continued forward into a very long bony apophysis, that is soldered with the furcula; the hindward emarginations are inconsiderable, the exterior pair being commonly reduced to a foramen, or even quite ossified. This bird is not naturally wild, and is observed in small flocks, which commonly perch side by side on some branch, always in marshy situations.\* It appears to have only ten tail-feathers.

We now arrive at the normal series of Poultry-birds, which have the hind-toe small and elevated.]

THE PEAFOWL (*Pavo*, Lin.).—

So named (*Paon*) from their cry, and which are characterized by a crest of peculiar form; and by the tail-coverts of the male extending far beyond the quills, and being capable of erection into a broad and gorgeous disk. The shining, lax, and silky barbs of these feathers, and the eye-like spots which decorate their extremities, are well known to every one, as exemplified in

The Indian Peafowl (*P. indicus*, Lin.), the head of which is adorned with an aigrette of narrow vertical feathers, widened at the tips. This superb bird, originally from the north of India, [where it still exists abundantly in a state of nature], was introduced into Europe by Alexander. The wild specimens even surpass the domestic ones in brilliancy. The blue extends over the back and wings, instead of the common barred markings; and their train is still longer. [We have seen domestic Peacocks with these characters, which however are not attained by the greater number; and have also observed wild-shot birds like the ordinary breed, which it may be suspected had not acquired their final colouring; the developement of which would seem to be generally arrested in the former, so much so that we have seen an individual more than eighteen years of age, that did not differ from the common farm-yard specimens].

The Japanese Peafowl (badly named by Linnæus *P. muticus* †, as it possesses spurs), is a distinct species, the aigrette of which is composed of long and narrow feathers; its neck is green instead of blue, and undated or gilded: train scarcely differing from that of the other.

[The additional species ranged by the author among the Peafowl are distinct enough, and now generally known as

THE PEAFEASANTS (*Polyplectron*, Tem.).

They are much smaller, and particularly remarkable for the tarsi of the male bearing two or more spurs.] The tail-coverts, which do not extend beyond the tail, and are webbed in the ordinary manner, have two brilliant metallic spots, and the wing-tertiaries have sometimes single ones.

[Three or four species are known, from the mountains of eastern Asia.]

THE IMPEYAN (*Lophophorus*, Tem.).

The head surmounted by an aigrette like that of a Peafowl, and a similar flat tail, the coverts of which,

\* L'Hermier, in *Annales des Sciences Naturelles* for 1837.

† We suspect that this name originated in a misprint for *mutus*, which was afterwards continued, this bird having no harsh cry like the other.—En.

however, are not prolonged. It also resembles the Peafowl in the brilliancy of the colours of the male: circumference of the eye, and even the cheeks, naked, as in the Pheasants, and the tarsus armed with stout spurs. [The upper mandible very much overhangs the under one, as observable in a less degree in the Pheasants generally, enabling this bird to root up bulbs with facility.]

We know but one species, from the mountains of the north of India, the Resplendent Impeyan (*L. refulgens*, Tem.; *Phasianus impeyanus*, Lath.). Size of a [small] Turkey, and black; the crest and dorsal plumage of changeable colours, reflecting tints of gold, copper, sapphire and emerald: tail-feathers chestnut-rufous, [and the rump white]. The female and young are brown, dashed with grey and fulvous.

#### THE TURKEYS (*Meleagris*, Lin.)—

Have the head and upper part of the neck invested with a naked, mammellated skin; an appendage under the throat, and another conical one on the forehead, which becomes inflated and prolonged when the bird is excited by passion, when it hangs over the beak. On the lower part of the neck in front, the adult male has a tuft of very long pendent bristles; the coverts of the tail, shorter and more stiff than in the Peafowl, can be expanded in like manner into a fan. The males have weak spurs, [and are the only American Poultry-birds wherein a trace exists of those appendages].

But one species was known for a long time, the Common Turkey (*M. gallipavo*, Lin.). It was brought from North America during the 16th century, and was soon diffused throughout Europe, where it continues to be reared for the excellency of its flesh, its great size, and the facility with which it is bred. The Wild Turkeys vastly exceed the domestic breed in brilliancy, and are of a greenish-brown, glossed with copper reflections.

A second, however, has been recently described, the Ocellated Turkey (*M. ocellata*, Cuv.), which approximates the Peafowl in the splendour of its colours, and by the disks of saphirine-blue, inclosed by circles of gold and ruby-red, which adorn the tail-coverts. It was captured in the Bay of Honduras.

[We may here introduce a large Poultry-bird of New Holland,

#### THE VULTURN (*Alectura*, Gray),—

Which has been strangely arranged by some authors among the Vultures, on account of its bald neck. From the Poultry generally, it is distinguished by the shortness of the downy plumage of the rump, as in the Touracos; its hind-toe is large, and on the same plane with those in front, the same as in the Curassows, like which it is also destitute of spurs; but its tail-feathers are eighteen in number.

One species only is known (*A. Lathamii*, Gray), entirely of a dusky colour, the feathers of the under-parts tipped with whitish.]

#### THE PINTADOS (*Numida*, Lin.),

Or Guinea-fowl, have a naked head, and fleshy wattles below the cheeks, a short tail, and the skull generally surmounted by a callous crest. Their feet are without spurs; the tail short and pendent, so that the long feathers of the croup impart a rounded figure.

The common domestic species (*N. meleagris*, Lin.), originally from Africa [the indigenous habitat of all], has a slate-coloured plumage, everywhere speckled with round white spots [of different sizes]. Its noisy and querulous disposition render it an incommodious species in poultry-yards, although its flesh is excellent. In the wild state, they live in large flocks, and prefer the neighbourhood of marshes.

[Three or four others are known, of which *N. vulturina*, Gould, is the most beautiful, having pointed purple feathers on the lower part of the neck; the body-plumage of all being nearly similar. The Crested Pintado (*N. cristata*, Pallas), is very remarkable for the appendage to the furcula forming a sort of cup, in which the trachea undergoes a convolution. No trace of this structure exists in the common species.]

The great genus of

#### PHEASANTS (*Phasianus*, Lin.)—

Is characterized by partly naked cheeks, covered with a red skin, and by the tectiform tail, the feathers of which are variously disposed. We first distinguish among them

#### THE FOWLS (*Gallus*, Cuv.),—

The head of which is surmounted by a vertical fleshy comb, and the inferior mandible furnished on each side with fleshy wattles. Their tail-feathers, fourteen in number, are elevated on two vertical planes, placed back to back; the coverts of that of the male are prolonged to form the arch over the tail proper.

The species so common in our poultry-yards, [absolutely without a special English name] (*Ph. gallus*, Lin.), varies endlessly in colour, and very much in size: there are races wherein the fleshy comb is replaced by a crest of reverted feathers; some in which the tarsi and even the toes are feathered; another in which the crest, wattles, and periostium of the whole skeleton are black; and some monstrous kinds which have hereditarily five and even six toes to each foot.

## GALLINÆ.

Several wild species are also known, as that of Sonnerat (*Gal. Sonneratii*, Tem.), which is very remarkable for the neck feathers of the male, the stems of which widen into three successive disks of a horny nature. The comb of the same sex is denticulated. This species inhabits the Ghauts of Hindoestan.

M. Leachenhault has procured two others from Java: one (*G. Beakies*, Tem.), with a denticulated crest like the preceding; all the feathers of the neck long, pendent, and of the most beautiful golden red: it appears to me to bear the greatest resemblance to our domestic races: the other (*Ph. varius*, Shaw; *G. swanfus*, Tem.), is black, with a copper-green neck, speckled with black, its crest plain, and a kind of small dewlap instead of wattles.

### THE PHEASANTS, properly so called (*Phasianus*, Cuv.)—

Have a long graduated tail, each of its quills being inclined on two planes, and covering each other.

The most common of them (*Ph. colchicus*, Lin.), was brought from the banks of the Phasis by the Argonauts, and is now diffused over all temperate Europe, where it requires, however, considerable care. [Another, from China, with a white ring round the neck, and a greener general cast of colour, but otherwise closely allied, has also been turned wild, and produced a prolific race of hybrids with the Common Pheasant, intermediate specimens in every degree being not uncommon. The pure breed of *Ph. colchicus* is distinguished by the total absence of the white ring, and reddish-copper tint of the croup, instead of greenish.

China produces several other species, with most superb plumage, as

The Golden Pheasant (*Ph. pictus*), and Amherst Pheasant (*Ph. Amherstii*), which have both a gorgeous ruff round the neck, and the latter in particular an exceedingly long tail, the feathers widening in the middle.

The Reeves's Pheasant (*Ph. Reevesii*), from the same country, is one of the most magnificent of birds. It is half as large again as the common species, with a tail exceeding six feet in length. *Ph. versicolor*, and *Ph. Soemeringii*, from Japan, are also truly splendid, and nearly allied to the common one.

Others approximate the Common Fowl in their carriage, as the Silver Pheasant (*Ph. nycthemerus*), from China, and the Lineated (*Ph. lineatus*), from the mountains of Thibet: both these have purple-black under-parts, with the feathers above white and lineated; a pendent crest on the head. *Ph. albocristatus* comes still nearer to the Fowl, retaining the head only of the Pheasant group; and *Ph. pucrasia*, is perhaps the dullest of the whole genus, with a pointed short tail, but is otherwise allied to the ordinary species: the two last are from the Himalayas]. The females of all are sombre [that of *Ph. Reevesii* the least so, which is beautifully variegated with white upon the neck,] and have shorter tails.

We conceive that the description of the Phoenix, by Pliny, (lib. x. cap. 2), was drawn up from a specimen of the Golden Pheasant.

One of the most singular of all Birds is

The Argus (*Ph. argus*, Lin.).—A large Pheasant from the south of Asia, the head and neck of which are almost naked. The tarsi are without spurs; a very long tail in the male; the secondary quills of the wing excessively elongated, widened, and covered throughout their length with ocellated spots, which, when spread out, impart an extraordinary aspect to the bird. It inhabits the mountains of Sumatra and some other countries of the south-east of Asia, and constitutes the genus *Argus* of Temminck.

### THE MACARTNEYS (*Euplocamus*, Tem.)—

With the naked cheeks common to this genus, have the vertical tail and arched coverts of the Cocks, together with erectible feathers on the head, which form a crest similar to that of the Peafowl. The projecting lower edge of the naked skin of their cheeks supplies the place of wattles. The tarsi are armed with strong spurs.

We are acquainted with one only, from the Isles of Sunda (*Phasianus ignitus*, Shaw); size of a Cock, and brilliant black, with a golden-red rump, the upper tail-coverts yellowish or whitish, and the flanks spotted with white or fulvous. Female brown, finely streaked with blackish above, and dashed with white beneath; crested like the male. [The *Ph. albocristatus* might be placed with it.]

### THE TRAGOPANS (*Tragopan*, Cuv.)—

Are [with the exception of one species] remarkable for the singular adornment of the head, which is almost naked, with a small slender horn [or erectible excrescence] behind each eye, and a wattle susceptible of inflation under the throat. There are short tarsal spurs in both sexes.

[Four species are now known, all beautifully spotted with white, somewhat as in a Pintado, and in three of them upon a gorgeous red ground-colour; the naked parts are also vividly tinted with rich blue and yellow. Females and young dull brown. They inhabit the Himalaya range of mountains, and perch like Pheasants].

We should separate from the Pheasant group

### THE CRYPTONYX, Tem.—

Wherein the immediate circumference of the eye alone is naked, the tail is moderate and plain, and the tarsi are without spurs. Their most remarkable character, however, consists in the absence of the hind-claw.

In the only well-known species (*Cr. coronatus*, Tem.), the male has a long crest of thinly-barbed rufous feathers, and some long barbed stems over each eyebrow. Plumage bright green and blue. [Another (*Cr. niger*), is wholly black, with the female brown. There are two or three more, all from India and its islands].

#### THE GROUSE (*Tetrao*, Lin.)—

Have a naked great space, characterised by a naked space, generally of a bright red colour, in place of an eye-brow. It is subdivided in the following manner.

#### THE RESTRICTED GROUSE (*Tetrao*, Latham)—

Have feathered tarsi without spurs. Those to which we more particularly confine the name have a rounded or forked tail, and naked toes. [They are polygamous, and spread the tail and strut in the manner of Turkeys].

The Bearded or Wood Grouse, Capercaillie, or Cock of the Wood (*T. urogallus*, Lin.), is the largest of the true Poultry, surpassing the Turkey in size. Its plumage is slate-coloured, finely rayed with blackish, [the breast shining bottle-green]; female fulvous, barred with brown or blackish. It inhabits the extensive mountain forests of the north of Europe, nestles in the heather or newly-cleared grounds, and subsists on buds and berries, [and particularly pine-shoots]. Its flesh is excellent, and the trachea makes two curves before entering the lungs.

The Black Grouse (*T. tetrix*, Lin.).—Black, with some white on the wing-coverts and beneath the tail, the two outermost feathers of which are forked and curled outward. Female fulvous, barred with whitish and dusky black. Their size that of the Domestic Cock and Hen. Found also in the European mountain forests. [There is a nearly allied species in Siberia].

An intermediate species appears to exist in the north of Europe (*T. intermedius*, Langsdorf). [It is still very doubtful whether this be not a hybrid between the Bearded and Black Grouse.

Several more exist in North America; one (*T. cupido*) is remarkable for a double nuchal crest, and an expansive globular pouch on the sides of the neck, of the colour and size of an orange, which is inflated when the bird is strutting. Others, the *Centrocerus*, Swainson, have sharp-pointed tail-feathers, and shorter wings; they inhabit the open country, and do not perch. Such is *T. urophasianus*, Bonap., the great Cock of the Plains, which is one third smaller than the European Wood Grouse, with some inflatable skin on the sides of the neck.

Others again,

#### THE BONASIA, Bonap.—

Have a naked strip along the front of the tarsi, and the coronal feathers lengthened; as]

The Hazel Grouse (*T. bonasia*, Lin.).—Scarcely larger than a Partridge, and prettily mottled, grey and rufous. Inhabits temperate Europe. [We have found its crop and stomach filled with birch catkins.] Another (*T. umbellus*, Gmelin), in North America, is about a third larger.

#### THE PTARMIGAN (*Lagopus*, Cuv.)—

Are species with a round or square tail, the toes of which are feathered like the tarsi. [They are monogamous, and do not strut with expanded tail-feathers]. The more generally diffused species become white in winter.

The Common Ptarmigan (*T. lagopus*, Lin.).—Inhabits our highest mountains, and shelters itself, in winter, in

holes which it burrows in the snow [a habit which is also practised by the common Partridge.] The Willow Ptarmigan (*T. salicetii*, Tem.), from the whole north, is larger, with a stouter bill. [Though not found in Britain, like the last, it is the common species of the London markets. Another, still more densely clad (*L. bradydactyla*, Gould), occurs in Russia, and there are additional species in Iceland and in North America].

There is a Ptarmigan in Scotland, however, which does not change colour in winter.

The Heath Ptarmigan (*T. scoticus*, Latham).—[Common Moor-fowl, or Red Grouse of sportsmen, remarkable for being quite restricted in its distribution to the British islands: it renews its feathers twice a year, however, like the others].

We may here separate by the name of

#### THE GANGAS (*Pterocles*, Tem.)—

The species with a pointed tail and naked toes.

The circumference of the eyes alone is naked, and

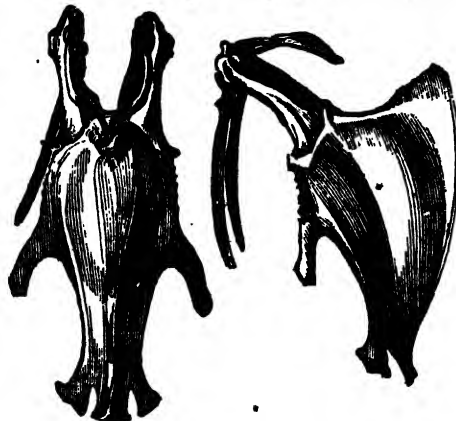


Fig. 108.—Sternum of Ganges.

not of a red colour: their thumb is very small. [The wings are remarkably long and pointed, with the

first quill longest, and flight extraordinarily swift; sternal crest more developed than in any other bird whatever, the inner emargination of the sternum almost obliterated: furcula singularly short and wide, without any appendage: the alimentary passage resembles that of other Poultry, having coeca as much developed as in a Partridge. The feathers are moulted twice a year, and resemble those of the Bustards, both sexes being alike in winter, and the male acquiring a peculiar garb in summer. They lay few eggs, and the young do not follow their parents for some time, but are fed by them in the nest. They inhabit the arid deserts of Africa and Arabia, and are peculiar to the eastern hemisphere.]

One (*T. alchata*, Lin.), inhabits the south of France and borders of the Mediterranean. [Another (*T. arvensis*, Pallas) occurs in Spain, and a third (*Pt. caspicus*, Menetr.) is found in south-eastern Europe. There are many more.

Closely allied to the Ganges, we deem

#### THE TETRAOGALLUS, Hardwicke,—

A large species from the mountains of the north of India, with shorter wings and comparatively stout bill. The tarsi are armed with spurs, and the first five quills are nearly equal. {

It is the *T. nigelli*, Gray].

#### THE PARTRIDGES (*Perdix*, Brisson),—

Have the tarsi naked as well as the toes. Among them

#### THE FRANCOLINS (*Francolinus*, Tem.)—

Are distinguished by their longer and stouter beak, more developed tail, and generally by their stout spurs.

There is one in southern Europe (*T. francolinus*, Lin.), with red feet; the neck and belly of the male black, with round white spots, and a vivid rufous collar.

Some of the foreign species are remarkable either for possessing double spurs, or a naked skin on the throat, or they combine these two characters: others, again, have a particularly large beak, and are without spurs.

#### THE RESTRICTED PARTRIDGES—

Have the beak not quite so stout: the males have short spurs, or simple tubercles, which are wanting in the females.

Every one is acquainted with

The Grey Partridge (*T. cinereus*, Lin.), that prolific species of game, which lives and propagates in our fields, and is so highly esteemed for the table.

The Red Partridge (*T. rufus*, Lin.) [and five or six others with the same general character of plumage, form a natural group, the first dress of which is analogous to that of the preceding. All are peculiar to the eastern hemisphere.]

#### THE QUAILS (*Coturnix*, Tem.)—

Are smaller than the Partridges; with a more slender beak and shorter tail: they have neither spurs nor red eyebrow, [and have longer wings. All are peculiar to the eastern hemisphere, where they are generally diffused].

The Common Quail (*T. coturnix*, Lin.), a small European bird, celebrated for its migrations across the Mediterranean. [There are many others.]

#### THE COLINS (*Ortyx*, Stephens),—

Or Partridges and Quails of America, have a shorter and stouter beak, more convex above: their tail is somewhat larger. They perch on branches, and, when disturbed, even on trees.\* Several species migrate like our Quails.

[Some have remarkable recurved topknots, in one of extraordinary length].

We are obliged to separate from the whole genus of Grouse

#### THE ORTYGANS (*Hemipodius*, Tem.),—

Which have no thumb, and the compressed beak of which forms a slight projection under the lower mandible. They cannot, however, be properly classed until their anatomy is known. The species are polygamous, and inhabit sandy regions.

Some of them,

#### THE ORTYGANS (*Ortyx*, Illiger),—

Have the general aspect of Quails, with toes separated to their very base, having no small membrane. [The chief peculiarity of their anatomy consists in the absence of a claw.]

The natives of Java train one species for fighting (the *H. pugnas*), as Game-Cocks are trained in England.

\* The Red Partridge will sometimes do this.—En.



Others,

THE ATTAGENS (*Syrhaptes*, Illiger).—

Are so far removed from the general type of the Poultry, that it is even doubtful whether they should range in the present order. [They appear to be nearly related to the Ganges.] Their short tarsi are feathered, as are also the toes, which are short, and joined together for a part of their length; the wings being extremely long and pointed.

But one species is known, from the deserts of central Asia [and very rarely eastern Europe,] (*T. paradoxus*, Pallas), the *Heteroclytus* of Temminck.

We are equally necessitated to separate from the Grouse

THE TINAMOUS (*Tinamus*, Latham; *Crypturus*, Illiger).—

An American genus, remarkable for a long and slender neck, (although the tarsi are short,) covered with feathers, the tips of the barbs of which are slender and slightly curled, which imparts a peculiar air to that part of their plumage. The beak is long, slender, and blunt at the end; somewhat vaulted, with a small groove at each side: the nostrils are pierced in the middle of each side, and penetrate obliquely backwards. Their wings are short, and they have scarcely any tail. The membrane between the base of their toes is very short. Their thumb, reduced to a spur, cannot touch the ground. They have a

small naked space round the eye. These birds either perch on low branches, or conceal themselves in tall grass; they live on fruits and insects, and their flesh is very good. Their size varies from that of a Pheasant down to that of a Quail, or even still smaller. [Eggs of a deep purple colour.]

Some of them (the *Perus* of Spix), have a small tail concealed under the feathers of the rump. Others (the *Tinamus* of Spix) have no tail at all, and the nostrils are placed a little further backward.

We should distinguish the *Rhynchotis* of Spix, wherein the beak, which is stronger, has no groove, and is a little arcuated and depressed, with the nostrils pierced towards the base.

THE PIGEONS (*Columba*, Lin.)—

May be considered as forming some passage from the *Gallinae* to the *Passerinae*. As in the former, their beak is vaulted, the nostrils are pierced in a large membranous space, and covered with a cartilaginous scale, which even forms a bulge at the base of the beak: the



Fig. 110.—Sternum of Tinamou.

bony sternum (fig. 111) is deeply and doubly emarginated, although somewhat differently [the inner notch being mostly reduced to a foramen; the ridge of the sternum deep, and rounded off anteriorly (much as in the Parrots); and the furcula flat and destitute of any appendage]. The crop (fig. 70, p. 160) is extremely large [and double, or expanding on each side of the oesophagus, in which it differs from that of any other bird; it also secretes a lacteal substance, as in the Parrots, during the period of incubation. The gizzard is powerfully muscular; the intestines very long and slender, with minute cæca; and there is no gall bladder]. The inferior larynx is furnished with but one muscle proper—[we have invariably found two pairs]; but there is no other membrane between the base of the toes than that which results from the continuity of the edges. The tail consists of twelve feathers, and they fly tolerably well. These birds are invariably monogamous, nestle in trees or the holes of rocks, and lay but very few eggs, ordinarily two, though they breed often. Both sexes incubate, and they feed their young by disgorging grain macerated in the crop. They form but one great genus, which naturalists have attempted to divide into three subgenera, from the greater or less strength of the bill, and the proportions of the feet.



Fig. 111.—Sternum of Pigeon.

THE GOURAS (*Lophyrus*, Vieillot).—

Approximate the ordinary *Gallinaceæ* more than the other subgenera, by their more elevated and gregarious habits, finding their food more on the ground, and never [not so habitually] perching. Their beak is slender and flexible, [and their anatomy precisely that of the others].

One species is even allied to the *Gallinaceæ* by the caruncles and other naked parts about the head (the *C. carunculata*, Tem.)

Another, at least, approaches them in size, which almost equals that of a Turkey,—the Crowned Pigeon of the Indian Archipelago (*C. coronata*, Gm.).—Entirely of a slaty-blue, with some chestnut and white on the wings; the head adorned with a vertical longitudinal crest of thinly-barbed feathers. It is bred in the poultry-yards of Java, &c., but refuses to propagate in Europe. It is to this species that the names *Goura* and *Lophyrus* especially apply.

A third approximates the Poultry by the long pendent feathers of its neck, somewhat as in the Cock,—the Nicobar Pigeon (*Col. nicobarica*, Lin.), of a brilliant golden-green colour, the tail white. It is found in many parts of the Indian Isles, [and propagates in the same manner as the others, contrary to what has been asserted.

Other small species compose the *Chamepelia*, Swainson, as the Ground Dove of Wilson's American Ornithology, *C. passerina*, Lin.]

THE RESTRICTED PIGEONS (*Columba*, as limited).—

Have shorter legs than the preceding, but the same flexible and slender bill.

There are four wild species in Europe.

The Cushat, or Ring Dove (*Col. palumbus*, Lin.), is the largest of them. It inhabits forests, and more particularly those of evergreens, and is of a bluish ash-colour, rufous beneath, and distinguished by a spot of white on each side of the neck. [It nestles on the branches of trees.]

The Stock Pigeon (*C. œnas*, Lin.).—Of a slaty-grey colour, vinous beneath, with some changeable green upon the neck. Rather smaller than the last, and similar in its general habits. [It breeds, however, either in convenient holes of trees, or in leafy pollards termed *stocks*, and not unfrequently in rabbit-burrows; makes no flapping sound with the wings in flying, like the next species].

The Rock Pigeon (*C. livia*, Brisson).—Slaty-grey, some iridescent green on the neck, two black bars on each wing, and a white rump. The Dovecot Pigeon is derived from this species, and, it would appear, the greater number of the innumerable domestic breeds, in the production of which, however, the admixture of some proximate species may likewise have an influence. [The wild Rock Pigeon breeds principally in sea-cliffs, and but sparingly inland. There is a race, which we suspect to be a distinct species, closely allied, the wings of which are spotted, somewhat as in the Stock Pigeon, but more extensively, in place of the black bars. Numbers of them, all shot, are sold in the London markets. We will term it *C. macularia*.]

The Turtle Dove (*Col. turtur*, Lin.).—A fulvous-brown mantle, spotted with brown, the neck bluish, with a spot on each side, variegated black and white. It is the smallest of the European wild Pigeons, and resembles the Cushat in its habits, [excepting in being migratory].

The Collared Dove (*Col. risoria*, Lin.), appears to have been originally from Africa. It is of a reddish-white colour, pale below, with a black collar on the neck.

The species of this division are extremely numerous, and might be further subdivided according as the tarsi are naked or feathered, and upon the naked space surrounding the eyes of some of them. Those with feathered tarsi constitute the *Ptilinopus*, Swainson.

Some have even caruncles and other naked parts on the head: and there are others [the *Ectopistes*, Swainson], which might be separated on account of their pointed tail.

But the best of all the divisions that have been instituted among the Pigeons is that of

THE VINAGOS (*Vinago*, Cuv.).—

Which are recognized by having a stouter bill, of solid substance, and compressed laterally: their tarsi are short, and their feet large and well bordered. They inhabit extensive woods, and subsist on fruit. But few species are known, all from the torrid zone of the eastern continent.

[They have generally vivid-green plumage, variegated with bright yellow]. One has a pointed tail.

## THE FIFTH ORDER OF BIRDS,—

## THE STILT-BIRDS (GRALLÆ, Lin.).—

Also termed *Shore-birds* and *Waders*, names which are derived from their habits and conformation. The members of this division are recognized by the nudity of part of the tibia, and most commonly by the elongation of the tarsi; conditions which permit them to enter

the water to a certain depth without immersing the feathers, and to wade therein and seize fish by means of the neck and beak, the length of which is generally proportioned to that of the legs. The stronger among them feed on fish and reptiles, and the weaker on worms and insects. A very few content themselves in part with grain or herbage, and these alone inhabit land, distant from any water. Their external toe is most commonly united at base to the middle one, by means of a short membrane; in some there are two membranes, while others want them entirely, having the toes quite separated; it also sometimes happens, though rarely, that they are palmated to the end: the thumb is altogether wanting in several genera; and all these circumstances exert an influence on their mode of life, which is more or less aquatic. Nearly the whole of these birds, if we except the Ostriches and Cassowaries, have long wings and fly well. They stretch out their legs backward during flight, contrary to what is observed of others [or at least those of the foregoing orders], which double them under the belly.

In this order we establish five principal families, together with some isolated genera.

The first family of Stilt Birds, that of

#### THE BREVIPENNES,

Although generally similar, in other respects, to the rest, differs widely from them in the *shortness of the wings, which are inadequate to perform the function of flight.* The beak and regimen give them numerous affinities with the *Gallinaceæ*.

It appears as if all the muscular power which is at the disposal of nature, would be insufficient to move such immense wings as would be required to support their massive bodies in

the air: their sternum (fig. 112) is a simple buckler, and without the ridge which exists in all other Birds. The pectoral muscles are reduced to extreme tenuity; but the posterior extremities regain what the wings have lost. The muscles of their thighs, and of the legs especially, are of an enormous thickness.

[Most, if not all, of these birds, are remarkable for their singular mode of incubation. In the Ostrich, Emeu, and Nandou, it appears that several females lay in the same nest, the eggs being chiefly sat upon by the male, who feigns lameness when disturbed: an artifice practised by the generality

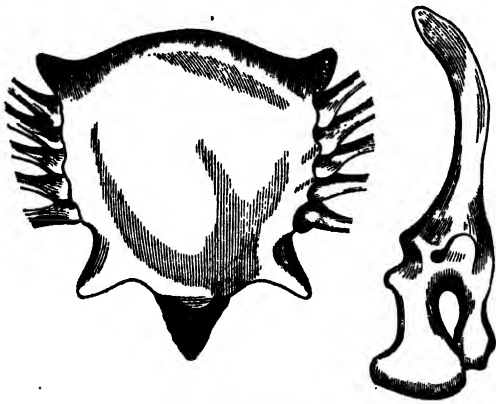


Fig. 112.—Sternum of Ostrich.

of ground-birds. It may therefore be presumed that they are polygamous, the attendant females of each male depositing their eggs together, commonly to the number of thirty, or even more.]

They all want the back-toe. In the Ostrich, the number of phalanges to the two front-toes are four and five; in the Cassowary, [Emeu,] and Nandou, the phalanges of the three front-toes number three, four, and five, respectively. We recognize two genera.

#### THE OSTRICHES (*Struthio*, Lin.),—

Have lax and flexible feathers on the wings, which latter are sufficiently long to accelerate their speed. Every one is acquainted with the elegance of these slender-stemmed feathers, the barbs of which, though furnished with secondary barbules, do not hitch in each other, as is the case with feathers generally. The beak is horizontally depressed, of mean length, and blunt at the tip; the tongue short, and rounded like a crescent; and the eye large, with its lids garnished with lashes. Their legs and tarsi are very long. They have an enormous crop, and considerable proventriculus between the crop

and gizzard, voluminous intestines, and long cæca, also a vast receptacle in which the urine accumulates, as in a bladder; they are accordingly the only birds that urinate. The penis is very long, and often protruded.

But two species are known, each of which might form a separate genus, [and they are now generally recognised as such, an additional species having been discovered of one of them.]

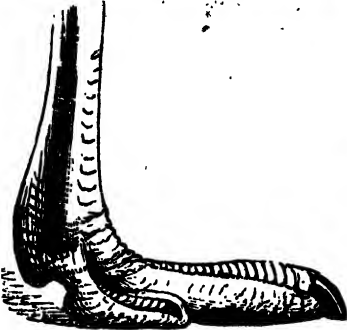


Fig. 112.—Foot of Ostrich.

possessing three toes to each foot, all of which are furnished with claws. Its plumage is greyish, inclining to brown above, with a black line descending along the neck of the male. Is not less abundant in South America than the other is in Africa. It is easily tamed when taken young, and its flesh during youth is eaten. [The tail of this bird are scutellated.

A second South American species (*Rh. Darwinii*, Gould; *Rh. pennata*, D'Orbigny), is one fifth less in size, with reticulated tarsi: it has also a more densely plumed wing, the feathers of which are broader, and are all terminated by a band of white. The bill is shorter than the head, and the tarsi are plumed for several inches below the joint. Inhabits Patagonia, where it is rare. Mr. Darwin observed that the Nandous swim with facility].

#### THE CASSOWARIES (*Casuarus*, Brisson).—

Have wings still shorter than those of the Ostriches, and quite useless in aiding progression. Their feet have three toes, all furnished with nails; and the barbs of their feathers are so little fringed with barbules, that at a distance they resemble pendent hair. [The accessory plume of the feathers (which in the Ostrich and Nandou does not exist at all) attains its maximum of development, so that two equal stems appear to grow from the same quill, while in the restricted Cassowary there is even a third in addition.]

Two species likewise occur of this genus, each of which might also be elevated to the rank of a genus, [now generally accepted].

The Galeated Cassowary (*Str. casuarus*, Lin.; [*Casuarus Emeu*, Auctorum]).—The beak laterally compressed, and head surmounted with a bony prominence, invested with a horny substance; the skin of the head and neck of an azure blue and flame-colour, with pendent caruncles, analogous to those of the Turkey: wings furnished with some rigid barbless stalks, which are employed as weapons in combat: the nail of the inner toe much the strongest. It is the largest species of bird, next to the Ostrich, from which it differs considerably in its anatomy; for it has short intestines and small cæca, wants the intermediate stomach between the crop and gizzard, and its cloaca does not proportionally exceed that of other birds. It lives on fruit and eggs, but not on grain; and lays dark-green eggs, few in number, which, like the Ostrich, it abandons to the heat of the sun. It is found in different islands of the Indian Archipelago.

The Emeu of New Holland (*Casuarus Novæ Hollandiæ*, Latham, [*Dromaius Novæ Hollandiæ*, Vieillot]).—A depressed beak, with no casque on the head, nor naked space except around the eye; the plumage brown, more dense, and the feathers more barbed; no caruncles, nor spurs to the wing; and the nails of the toes nearly equal. and the young are striped brown and white.



Fig. 114.—Sternum of Emeu.

Its flesh resembles beef: it is swifter than the fleetest Greyhound, [Either this or more probably an allied species has been extirpated

in New Zealand, where some bones of it have been found, and a tradition of its destruction is preserved by the inhabitants.]

N. B.—We cannot with propriety admit into this series, species so little known, or so ill-authenticated, as those which compose the genus of

*Dodos (Didus, Lin.),—*

The first species of which (*D. ineptus*) is only known from the description of it by the early Dutch navigators, preserved in Clusius (*Exot.* p. 99), and by an oil-painting, of the same epoch, copied by Edwards, pl. 294; for the description by Herbert is puerile, and all the rest are copied from Clusius and Edwards. It seems that the species has entirely disappeared, for at the present time there is only a foot of it extant in the British Museum, and an ill-preserved head in the Ashmolean Museum at Oxford. The beak appears to be not without some resemblance to that of the Awks, and the foot would resemble that of the Penguins, had it been palmed. [Since this was written, the author personally examined these last precious remains of the now extinct Dodo, and was not merely satisfied of their validity and total generic distinctness, but expressed an opinion that the foot also preserved at Oxford was specifically different from that in the British Museum.]



Fig. 115.—The Dodo.

considers it the same as the first species, giving it however but three toes, while all the others allow that bird to have four. No one has been able to inspect any of these birds since the time of those voyagers.

*THE APTERYX, Shaw,—*

*Appears, of all Birds, to have the wings most completely reduced to simple rudiments.* Its general form is that of a Penguin, and size that of a Goose. The feet also bear some resemblance to those of the Penguins, but are not described to be palmed. The beak is very long, slender, marked on each side with a longitudinal groove, and furnished with a membrane at its base: [the nostrils are placed at the top of the upper mandible beneath, which passes beyond the under one]. Wing reduced to a little stump, terminated by a hook.



Fig. 116.—The Apterix.

[Several specimens of this singular bird have recently been received, more particularly in England, and its characters are now tolerably determined. It has no relationship whatever with the Penguin group, but there is every reason to place it in the present family. From all other birds, it differs in the completeness of its diaphragm, and in the absence of abdominal air cells; none of its bones are hollow. The sternum is exceedingly reduced, with one deep posterior emargination on each side, and also a pair of anomalous perforations or foramina towards the middle: the ribs are extraordinarily broad, and a single pair of vocal muscles are attached to the coracoids: stomach but slightly muscular, and intestines of mean length, with moderate-sized caeca. The feathers have no accessory plume, and their shafts are prolonged considerably beyond the barb; there are many long v-bristles about the base of the bill, which is invested with a ceral membrane. The feet have a short and elevated hind-toe, the claw of which is alone externally visible. The dimensions of the female appear to exceed those of the male, and her bill is longer. Size that of a domestic fowl; and colour deep brown.

This very interesting bird is nocturnal in its time of action, and subsists on insects. It runs with rapidity, and defends itself vigorously with its feet. Its native name is *Kivi-Kivi*, derived from its cry.]

The family of

*PRESSIROSTRES—*

Comprehends a number of genera with elongated tarsi, in which the back-toe is either quite absent, or so short as not to reach the ground. Bill moderate, but strong enough to penetrate

the ground in search of worms, [to obtain which they have the habit of patting with the feet, which causes the worms to rise]: those species in which it is more feeble frequent meadows and newly-ploughed land, where this food can be procured with greater ease: those which have stronger bills, subsist additionally on grain, herbage, &c.

#### THE BUSTARDS (*Otis*, Lin.)—

With the heavy port of the Poultry, combine rather a long neck and legs, together with a moderately stout bill, the superior mandible of which is slightly arcuated and vaulted; and they also further approximate the *Gallinacea* by the very small membrane at the base of their toes: but the nudity of the lower portion of the tibia, their whole anatomy, and even the flavour of their flesh, concur to place them in the present order, in common with various members of which they also want the back-toe, and the smaller species are nearly allied to the Plovers. They have reticulated tarsi, and short wings; fly little, hardly ever using their wings, except to assist them in running, the same as the Ostriches; and feed equally on grain, herbage, and worms and insects. [The stomach is very capacious, and extremely attenuated, contrasting remarkably with the muscular gizzard of the true Plovers; their plumage is moulted twice in the year, the males of most of them developing accessory ornamental feathers, or black under-parts, in the spring; and their flight, when they do fairly rise, is easy and winnowing, and capable of considerable protraction. The species are numerous, and confined to the Eastern Continent.

The two first, one indigenous, the other an occasional visitant, in the British Isles, possess a comparatively stout beak, which is compressed laterally.]

The Great Bustard (*O. tarda*, Lin.).—Bright buff-coloured plumage on the upper-parts, crossed with numerous black lines; elsewhere greyish-white. The male, which is the largest of European birds, has [in its summer dress] lengthened ear-coverts, which form a sort of large moustache on each side. This species, which is one of the finest kinds of game, frequents extensive plains, and nestles on the ground amongst the corn. [It is polygamous, and the female is much smaller than the male; the latter being further distinguished by a very capacious membranous sac beneath the tongue. The voice of the male is a remarkable explosive sound. This bird lays only two eggs, of a dark greenish colour, with some black patches: the young, when first hatched, are very like young Plovers. It has been nearly extirpated in Great Britain.]

The Little Bustard (*O. tetrax*, Lin.).—Less than half the size of the last species, and much less widely diffused; of a brown colour, speckled with black above, whitish underneath. The male with a black neck, [in summer plumage only,] and two white collars. [In this species, the sexes scarcely differ in size, from which we should infer that it is monogamous. It lays four or five spotless green eggs in corn-fields, and is also highly esteemed for the table.]

The greater number of exotic species have the bill more slender, [and depressed instead of compressed]. Among them we may remark

The Rufed Bustard (*O. Aoubara*, Desm.), of Africa and Arabia, [and rarely Spain, the male of] which is adorned with lengthened feathers on the sides of the neck. [Another species with this character exists in central Asia.]

#### THE PLOVERS (*Charadrius*, Lin.)—

Likewise want the hind-toe, and have a middle-sized bill, compressed, but swollen towards the tip. They may be divided into two subgenera.

#### THE THICK-KNEES (*Edicnemus*, Tem.).—

Wherein the tip of the bill is inflated above as well as beneath, and the groove of the nostrils extends only half the length of the beak. They are the largest of the Plover group, and live by preference upon arid and stony districts, feeding on slugs, insects, &c. They are allied to the smaller species of Bustards [in their exterior conformation, but not in the structure of the stomach, which is a muscular gizzard: their plumage also is moulted once only in the year, and they undergo no seasonal change of colour]. Their legs are reticulated, and they have a short membrane at the base of their three toes.

The European Thick-knee (*Ch. edicnemus*, Lin.; *Ed. crepitans*, Tem.).—Size of [larger than] a Woodcock, and fulvous-grey, with a brown streak along the middle of each feather; the belly white, and a brown space under the eye. [This is the *Stone Curlew*, *Whistling* or *Norfolk Plover*, as it is variously designated, which is common in several districts of South Britain, and well known wherever it occurs from its sonorous whistling. It lays but two eggs, which however do not resemble those of the Bustards, and taper at one end; the smaller Bustards (as we have seen) produce a greater number. The Thick-knees are for the most part migratory, but some regularly stay the winter. We have reason to believe that it rears more than one brood in a season. There are several exotic species, some considerably larger and much stouter].

### THE RESTRICTED PLOVERS (*Charadrius*).—

Have the beak swollen only above; and two-thirds of its length occupied by the nasal groove on each side, which renders it weaker. They live in numerous flocks, frequent low and humid places, and stamp the ground to cause the worms on which they feed to rise.

Those of France are merely birds of passage, which are met with in autumn and spring; near the sea-coast some of them remain till the beginning of winter. [They all breed, however, within the British Isles, and at least some of them in France also.] Their flesh is excellent. They form, with numerous exotic species, a tribe with reticulated tarsi, of which the most remarkable are

The Golden Plover (*Ch. puvialis*, Lin.).—Blackish, speckled with yellow at the tips of the feathers; the belly black [in summer, in winter white. It breeds on upland moors. There are others very closely allied, but smaller, in India, Australia, and North America].

The Dotterel Plover (*Ch. morinellus*, Lin.).—Grey or blackish, the feathers edged with whitish fulvous; a white streak over the eye, the breast and upper part of the belly bright rufous, and the lower part of the belly white. [It breeds on the very summits of mountains uncovered by snow; flies in large scattered flocks, which are not shy; and is partial to chalky districts: its feathers are much esteemed by anglers.]

The Ring Plover (*Ch. Mattioli*, Lin.).—Greyish brown above, white beneath, with a black [or in winter a brown] collar on the lower part of the neck, very broad anteriorly; the head marked with black and white, and the beak yellow tipped with black. Two or three races or different species inhabit these parts, varying in size and the distribution of the colours of the head. [Those of Britain are, first, the common Ring Plover, with plumage as above described, and orange-coloured legs, which is everywhere very abundant on the sea-coast, breeding both there and on heaths a little inland; the Kentish Plover (*Ch. cantianus*), with longer and black legs, and a rufous occiput, an inhabitant of shingle-beaches, and less deeply coloured; and the Little Plover (*C. minor*), which is a diminutive of the first, and of excessively rare occurrence to far north.] There are numerous other foreign species, with similar general distribution of colours.

Various exotic Plovers have scutellated tarsi, and form a small division (the *Puvianus*, Vieillot), of which the greater number of species possess spurs to the wings, and fleshy wattles to the head; some of them have both these characters.

### THE LAPWINGS (*Vanellus*, Bechst.; *Tringa*, Lin.).—

Have the same beak as the Plovers, and are only distinguished by the presence of a back-toe, which however is so small that it does not reach the ground.

In the first tribe of them (the *Squatarola*, Cuv.), this back-toe is scarcely perceptible. The bill is swollen underneath, and the nasal groove as short as in the Thick-knee. The feet are reticulated, and the tail of the European species is rayed black and white. It associates with the Plovers.

The Grey Lapwing, or Stone Plover (*Tringa squatarola*, Auct.).—[This bird differs only from the Golden Plover in the stoutness of its bill, and in possessing the small back toe. Its seasonal changes are the same, having the under-parts black in summer and white in winter; the feathers above are similarly mottled, only with whitish instead of yellow, except in the young, which is even speckled with yellow. From the true Lapwings and the *Puvianus*, this bird and the restricted Plovers differ in their pointed wings and reticulated tarsi; the latter having scutellated tarsi, broad and rounded wings, and a different system of coloration. Its habits are precisely those of the Golden Plover, and it breeds on some of the northern British moors.]

### THE RESTRICTED LAPWINGS (*Vanellus*, Cuv.).—

Have the hind-toe rather more developed, the tarsi scutellated, at least in part, and the nasal fossa prolonged over two-thirds of the beak. They procure worms in the same manner as the Plovers, [and are peculiar to the eastern hemisphere].

That common in Europe, the Crested Lapwing (*T. vanellus*, Lin.), is a handsome species the size of a Pigeon, of a richly bronzed black above, with a long and slender occipital crest. [Throat black in summer and white in winter, at which latter season the colours are comparatively dull.] It arrives in spring, lives and propagates in the meadows, and departs in autumn. The eggs are considered a great delicacy.

There are some species of this genus in hot climates, the wings of which are armed with one or two spurs, and others which have fleshy wattles at the base of the beak. They are very noisy birds, screaming at every sound they hear, and defend themselves with courage against birds of prey. Live also in the meadows. [A second European species of Lapwing, from the south-eastern countries, is the *V. gregarius*, Pallas, or *V. heptuscha*, Tem.]

### THE OYSTER-CATCHERS (*Hamatopus*, Lin.).—

Have the beak rather longer than in the Plovers and Lapwings, straight, pointed, and compressed into a wedge; strong enough to enable them to force open the bivalve shells of the mollusks on which they feed. They also seek for worms upon the ground. The nasal groove, which is very deep, occupies half the length of the bill, and the nostrils are pierced in the middle like a small fissure. Their legs are of mean length, the tarsi reticulated, and the feet divided only into three toes.



That of Europe (*H. astralegus*, Lin.) is commonly termed *Scooper*, from its black and white plumage; the belly, throat, and base of the wings and tail, being of the latter colour; beak and feet bright orange-red. [There are several more.]

We shall place near the Plovers and Oyster-catchers

THE COURSERS (*Cursorius*, Lacepede; *Tachydromus*, Illiger).—

The beak of which, more slender, but equally conical, is arcuated, without any groove, and moderately cleft; the wings are shorter, and the legs more elevated, and terminated by three toes, without any thumb or palmature. [They approximate the Bustards in appearance and habits, and have a similar large membranous stomach; but do not change colour with the seasons, and are very much smaller: are peculiar also to the eastern hemisphere].

One has been met with, but very rarely, in France and England, which is indigenous to the north of Africa, the Cream-coloured Courser (*C. isabellinus*, Meyer), of a pale fulvous colour above, white beneath, [the young transversely rayed above with narrow dusky lines. There are several others.]

As far as can be judged from the exterior, it is here that we should also place

THE CARIAMA (*Microdactylus*, Geoff.; *Dicholophus*, Illiger).—

Which has a longer beak, more curved, and cleft as far as the eye, which imparts somewhat of the physiognomy and disposition of the Birds of Prey, approaching also a little to the Herons. The legs, scutellated and very long, terminate in three short toes, a little palmated at the base, together with a thumb that does not reach the ground.

[This curious bird is most nearly related to the Guans, and should rank in the Poultry order: the affinity is particularly apparent when it is seen alive. In its anatomy, it chiefly differs from the Gallinaceous type in wanting the appendage to the furcula, which latter is otherwise similar to that of a Fowl, and in having the sternal emarginations much less deep. It is essentially a Poultry bird with the long legs of a Crane; but differs in its short and elevated hind-toe from the Carassows and Guans].

We are acquainted with one species only, from South America, (*M. cristatus*, Geoff.; *Palamedea cristata*, Gm.; *Saria*, d'Az.), which surpasses the Heron in size, and subsists on Lizards and insects, which it hunts for on high grounds and along the borders of forests. Plumage yellowish-grey, waved with brown; some thinly-barbed feathers at the base of the beak, forming a slight crest, which is thrown backward. It flies but seldom, and then badly; and its loud voice resembles that of a young Turkey. As its flesh is esteemed, it has been domesticated in several places.

The family of

CULTRIROSTRES

Is known by a long, thick, and stout beak, which is most generally trenchant and pointed, and is almost entirely composed of the birds comprehended in the genus *Ardea* of Linnaeus. In a great number of species, the trachea of the male [and of the female also] forms various curves: their cœca are short [or moderate], and the true Herons have even only one.

We subdivide it into three tribes, the Cranes, the Herons properly so designated, and the Storks.

The first tribe forms but one great genus, that of

THE CRANES (*Grus*, Cuv.).—

Which have a straight beak, but slightly cleft; the membranous groove of the nostrils, which is large and concave, occupying nearly half its length. Their legs are scutellated, with toes of moderate length; the external but slightly palmated, and the thumb barely reaching to the ground. A more or less considerable portion of the head and neck is bare of feathers in nearly all of them. Their habits are more terrene, and their nourishment is derived more from vegetables, than in the following genera: they have accordingly a muscular gizzard, and tolerably long cœca. The inferior larynx is provided with only one muscle at each side.

At the head of the genus we place, as Pallas has already done,

THE AGAMI (*Psophia*, Lin.).—

Which has a shorter beak than the others, the head and neck invested merely with down, and the circumference of the eyes naked. They live in the woods, and subsist on grain and fruits,



The best known species (*Ps. crepitans*, Lin.), inhabits South America, and is called the *Trumpeter*, from its faculty of producing a low, deep sound, which at first seems to proceed from the anus. It is the size of a large Capon; plumage black, with reflections of brilliant violet on the breast; and an ashy mantle tinged with fulvous above. This bird soon recognizes persons, becomes attached to them like a Dog, and when domesticated, it is said, may be left to take charge of other poultry. It flies badly, but runs with great swiftness, and nestles on the ground at the foot of a tree. Its flesh is considered good eating.

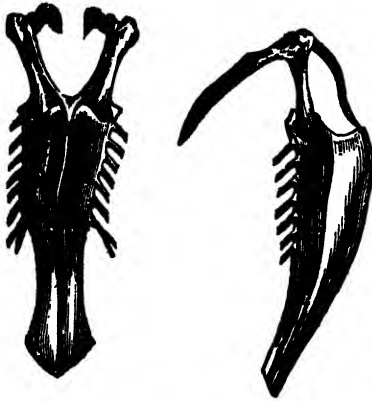


Fig. 117.—Sternum of the Agami.

[The location of this very singular species among the Cranes, is by no means satisfactory; but we do not know that it can be placed to greater advantage elsewhere. Its port resembles that of the Struthious birds (or *Brevipennes*); and the configuration of the sternum (fig. 117) is unique, not even approaching that of any other group. The trachea is much elongated, and continued under the skin of the abdomen, which occasions the sound of its voice to appear to come from that part. Upon the whole, we conceive that it is as nearly allied to the Tinamous, which inhabit the same region, as to any other known genus, and would prefer to detach it in a more marked manner from that of the Cranes. It has also some remote affinity with *Palamedea*.

#### THE RESTRICTED CRANES (*Grus*, Bechstein).—

Have ample wings, and considerably longer neck and legs. Their figure is much more elegant and graceful; and they feed on corn, and upon reptiles; chiefly frequenting humid districts in flocks that are often numerous. They do not run with speed; but have singular habits of attitudinizing, with expanded wings, and circling around each other with a light and tripping step. Their voice is very loud and harsh. Naturalists have further subdivided them, first into

#### THE BALEARICANS (*Balearica*, Vigors).—

The occiput of which is adorned with a peculiar bushy crest, composed of erect and crimped barbless stems of equal length; the forehead is clad with short and close feathers, of velvety appearance; and the throat is furnished with fleshy wattles. The sternum resembles that of a Heron; but the furcula is not ankylosed to its ridge, as in the others, nor does the trachea undergo any convolution; the laryngeal muscles are attached to the first true ribs. These birds perch with facility, and are very readily domesticated.

Two species are known, from eastern and western Africa respectively; the first with a pale grey neck, and much larger fleshy wattles, (*B. regulorum*); the other, which is more commonly brought alive to Europe, having a blackish neck and small wattles (*B. pavonia*). Both have also naked cheeks.

The rest have lengthened tertials, and no crest: the furcula is soldered to the sternal keel, and the latter is hollow and inflated to receive the trachea, which undergoes a convolution within it, as in several Swans. Such are

#### THE DEMOISELLES (*Anthropoides*, Vigors).—

Which have the head and neck quite feathered, and the tertials hanging over the tail to reach the ground. They are confined to Africa, like the last.

The Paradise Demoiselle (*G. paradisæus*, Vieillot; *Anth. Stanleyanus*, Bennett).—A large species, entirely of a delicate ashy-grey colour; the plumage of the head short and erectile, having very much the appearance of inflatable skin. The Numidian Demoiselle (*Ardea virgo*, Lin.) is much smaller, and characterized by a black neck, with two elegant whitish tufts on the sides of the head, formed by the prolongation of the ear-coverts.

Finally,

#### THE TRUE CRANES (*Grus*, Vigors).—

Have the beak as long as the head, or longer; the head and part of the neck generally naked; and the tertials commonly recurved. The species are comparatively numerous, and much more widely distributed. Habits migratory.

One is common in Europe, and sometimes occurs, but as an exceedingly rare straggler, in the British Isles, the European Crane (*Ardea grus*, Lin.; *Grus cinerea*, Bechst.)—Four feet and upwards in height, of an ash-colour, with a black throat; the summit of the head red and naked. This bird has been celebrated from the earliest ages, on account of its regular migrations, from north to south in the autumn, and back in the spring, which it effects in numerous and well-ordered flocks. It feeds on grain, but prefers the worms and insects of marshy

grounds. The ancients frequently speak of it, because the principal course of its migrations appears to be through Greece and Asia Minor.

Between the Cranes and Herons may be placed

THE COURLAN [*Aramus*, Vieillot,]

The beak of which, more slender and rather more deeply cleft than that of the Cranes, is swollen near the terminal third of its length; and the toes are comparatively long, without any basal membrane. [Its anatomy approaches that of the Rails].

The species (*Arde. scolopacea*, Gm.), resembles the Herons in size as well as manners, and has brown plumage, with some white pencils on the neck.

Also

THE CABLE (*Europyga*, Illig.),—

With a beak more slender than that of the Cranes, but marked with a similar nasal groove, and split nearly to the eyes, as in the Herons, but having no naked skin at its base.

It is a bird the size of a Partridge, with a long and slender neck, broad open tail, and rather short legs, which altogether impart a very different aspect from that of the wading birds in general. Its plumage, shaded with bands and lines of brown, fulvous, russet, grey and black, recalls to mind the colouring of some of the most beautiful Moths. It is found along the rivers of Guiana, [and we suspect is closely allied to the African genus *Rhynchæa*].

The second tribe is more carnivorous, and is characterized by its stronger beak, and longer toes: [they mostly nestle upon trees in large societies, and the young are at first helpless and naked]. At its head may be placed

THE BOATBILLS (*Cancroma*, Lin.),—

Which would completely resemble the Herons in the strength of their bill, and the kind of nourishment resulting therefrom, were it not for the extraordinary form of that organ; as, upon close examination, we find that it is merely the beak of a Heron or Bittern, very much inflated: in point of fact, the mandibles are singularly wide from right to left, and formed like the bowls of two spoons, the concave sides of which are placed in contact. These mandibles are very stout and sharp-edged, and the upper one has a pointed tooth on each side of its tip; the nostrils, pierced towards the base, are prolonged into two parallel grooves to near the end. The feet have four toes, all of them long, and nearly without connecting membrane; for which reason these birds perch on the branches of trees by the sides of rivers, from which they precipitate themselves on the fish, which constitute their ordinary food. Their gait is slow, and their attitudes constrained like those of the Herons. [The Boatbills are, in brief, simply modified Herons, from which they differ only in their inflated beak, conforming in their whole anatomy.]



Fig. 118.—Sternum of Purple Heron.

The known species (*C. cochlearea*, Lin.), is the size of a common Fowl, and whitish, with a grey or brown back, the belly rufous, and forehead white; head adorned with a black calotte, which, in the adult male, becomes a lengthened crest: it inhabits the hot and humid regions of South America.

THE HERONS (*Ardea*, Lin.),—

Have the beak cleft as far as the eyes, with a small nasal fossa prolonged into a groove nearly to the point: they are also distinguished by the pectinated inner edge of the claw of their middle toe. Their legs are scutellated, with the toes (including the hind one) rather long [and articulated on the same plane]: the palmature of the outer ones is considerable, and their eyes are placed in a naked skin, which extends to the beak. Their stomach is a very large sac, but slightly muscular, [the intestines extremely long and slender,] and they have only one minute cœcum. They are univiviparous birds, which nestle and perch by the sides of rivers, and consume a vast quantity of fish. The species are very numerous in both continents, and can scarcely be distinguished except by differences of plumage:

The True Herons have a very slender neck, with long and pendent feathers towards its base. As

The Common Heron (*A. major* & *A. cinerea*, Lin.).—Bluish ash-coloured, with a black occipital crest; the neck

white, marked on each side with a row of black tears; [dorsal plumage rounded in the young, pointed after the first moult, and much elongated and narrowed in the adult, all the feathers having a grape-like appearance, devoid of gloss, but rich in colouring. Both sexes alike.] A large bird, very noxious on account of the quantity of fish it destroys, and formerly celebrated for the sport which it afforded to falconers. [It breeds, like most of the genus, on the branches of high trees, many nests together, which are termed *Heronries*; seizes its prey by an instantaneous stroke of the bill, transfixing it if large; watches for it motionless; emits a loud cry or *honk*, and flies buoyantly: characters which mostly apply to the genus generally.]

We have also another species, the Purple Heron (*A. purpurea*) [smaller and more slender, with longer toes, like those of a Bittern. It breeds on the ground, and is rare in the British islands. Colour altogether more reddish.]

Certain small species with shorter legs are termed Dwarf-bitterns [the *Ardeola*, Bonap. They are in every respect true Bitterns, and resemble that of North America in immature plumage, acquiring a garb analogous to that of the Night-herons when adult.] There is one common in the mountainous districts of France (*Ardeola minuta* and *danubialis*, Gm.), which is scarcely larger than a Rail, and fulvous, with the calotte, back, and quills, black. It frequents the vicinity of ponds.

The Tiger-bitterns conjoin to the contour of the Dwarf-bitterns the stature of a Heron and the plumage of the ordinary Bitterns.

Egrets are Herons, the feathers of which, on the lower part of the back, at a certain epoch are lengthened and thinly barbed. [They are mostly pure white.] One of the handsomest of them, the Heron-crested Egret (*A. garzetta*, Lin.), is entirely white, with the dorsal plumage not extending beyond the tail, [and a long occipital crest of narrow feathers, resembling in shape those of the Common Heron. It is peculiar to the eastern continent]. Also the European Great Egret (*A. alba* and *egretta*), likewise wholly white, and the thinly-barbed dorsal plumage prolonged beyond the tail. [There are numerous others, in every part of the world. A third in Europe is the Buff backed Heron or Egret (*A. russata*), with a shorter and smooth yellow bill, longer toes, and coloured dorsal plumage in the adult, like the next species.]

We approximate to the Egrets the Squacco Heron (*A. comata* and *ralloides*), a bird of the south of Europe, with a russet-brown back, the belly, wings, and tail, white. The adult has a yellowish neck, [densely clad like that of a Bittern], and a long [striped] occipital crest: [the toes are also long, and the lengthened dorsal plumage of this and the last species are of a hair-like texture, besides resembling in colour. The present species occurs less unfrequently in the British Isles than either of the three last.]

Bitterns have the feathers of the neck lax and separated, which increases their apparent size, [at least when they erect them, which they have the power of doing to their whole clothing plumage]. They are commonly rayed or speckled, [and not so high on the legs].

The European Bittern (*A. stellaris*) is bright fulvous or clay-colour, mottled and speckled with blackish, and has green bill and feet. It is found among the reeds, whence it emits its terrific voice, which has caused it to be designated *Boo-taurus*. [This bird is not rare in Britain, runs with great celerity like a Rail, flies also with unwillingness, and with its legs hanging, during the day, and when surprised puffs out its plumage in an extraordinary manner, and strikes with its spear-like bill. In the evening it rises to a vast height in the air, in spiral circles, occasionally *bellowing* in its flight: it breeds among aquatic herbage in the marshes, and lays eggs of a dark brown colour.]

The Night-herons, with the same port as the Bitterns, have the beak proportionally much thicker, and some slender feathers [three in number] growing from the occiput of the adult. One only inhabits Europe (*A. nycticorax*, Lin.), the male of which is whitish, with the calotte and back black; the young brown above spotted with whitish, and the calotte dusky. [It is rare in Britain.]

In fine, we should remark that these different subdivisions of the genus of Herons are of trivial import, and by no means well defined. [Together with the Boatbills, they constitute a perfectly distinct group, strongly characterized by their anatomy, and particularly by the single minute cæcum, and the number of cervical vertebrae—seventeen.]

The third tribe, besides having a stouter and smoother beak, has tolerably strong and nearly equal membranes between the bases of the toes.

#### THE STORKS (*Ciconia*, Cuv.)—

Possess a thick bill, moderately cleft, without any fossa or groove, and the nostrils pierced towards the back and base; also an extremely short tongue. Their legs are reticulated, and the front toes strongly palmated at base, more particularly the outer. Their large and thin mandibles, by striking against each other, produce a clattering noise, which is almost the only sound these birds ever make. Their gizzard is slightly muscular, and their two cæca so small as to be barely perceptible. Their inferior larynx has no muscle proper; and the bronchi are longer and composed of more entire rings than usual.

We have two species in France.

The White Stork (*A. ciconia*, Lin.).—White, with black quill-feathers, and red bill and feet; a large bird, which the people hold in particular respect, doubtless originating from its utility in destroying Snakes and other noxious animals. It nestles by preference on towers and chimney-stacks, returning to the same every spring, after having passed the winter in Africa. [The reason that this species is not common in Britain, is that every pair are shot soon after making their appearance, which prevents the founding of a colony.]

[The Black Stork (*A. nigra*, Lin.).—Blackish, with rich purple reflections, and the belly white. It frequents retired marishes, and builds in the forests.

Among foreign species, we may distinguish

THE ADJUTANTS [*Argala*, Benn.],—

Or bare-necked Storks, the beak of which is still larger and alighter; and among them

The Pouched Adjutants (*Arde. dubia*, Gmelin; *A. argala*, Lin.); which have an appendage under the middle of the throat resembling a great sausage, and from beneath the wings of which are procured those light downy feathers, that are made into tufts called *Maribous*. Two species of them are known; one from Senegal, with a uniform mantle, (*Cic. maribou*, Tem.), the other from India, of which the wing-coverts are bordered with white, (*C. argala*, Tem.).—Their large beak enables them to capture birds on the wing. Add *C. capillata*, Tem.

THE JABIRUS (*Mycteria*, Lin.),—

Which were separated by Linnæus from *Ardea*, are very closely allied to the Storks, and much more so than the latter are to the Herons; the moderate opening of their beak, their nostrils, the reticulated envelope of their legs, together with the considerable palmature of the toes, are absolutely the same as in the Storks, which they further resemble in their mode of life. Their peculiarity consists in having the beak slightly curved upwards towards its extremity.

The best-known species (*M. americana*, Lin.), is very large, and white, with a bare head and neck, invested with a black skin, the lower part of which is red; the occiput alone has some white feathers, and the beak and feet are black. It is found along the borders of pools and marshes in South America, where it preys on reptiles and fish. The *Ciconia ephippiryncha*, Ruppell, only differs from *M. senegalensis*, Latham, in being drawn from the recent specimen.

THE UMBRES (*Scopus*, Brisson).—

Are only distinguished from the Storks by their compressed beak, the trenchant ridge of which is inflated towards the base, and the nostrils are prolonged by a groove which runs parallel with the ridge to its tip, which is slightly hooked.

One species only is known, the Crested Umbre (*Sc. umbretta*), as large as a Crow, and of an umber colour, the male crested. It is diffused over all Africa.

THE ANASTOMES (*Ilians*, Lacep.; *Anastomus*, Illig.).—

Are separated from the Storks by about as trivial a character as that which distinguishes the Jabirus. The mandibles of their beak come in contact only at the base and tips, leaving a wide interval between their edges, at the medial portion. Even this seems to be the result of detrition, for the fibres of the horny substance appear as though it had been worn away.

They are East Indian birds, one of which is whitish (*Ardea ponticertana*, Gm.), the other greyish-brown (*A. coromandeliana*, Sonnerat). Perhaps the latter is merely the young of the former. Both have black quill and tail-feathers. A third, of an iridescent black (*An. lamelliger*, Tem.), is remarkable for the stem of each of its feathers terminating in a narrow horny disk, which passes beyond the vane.

THE DROMES (*Dromas*, Paykull).—

Bear a close resemblance to the preceding, having nearly the same feet and contour; but their compressed beak, the base of which is a little inflated beneath, is pierced with oval nostrils, and the mandibles close completely.

We know only one species, from the shores of the Red Sea and banks of the Senegal (*Dromas ardeola*, Payk.) with white plumage, and part of the mantle and wings black.

THE TANTALS (*Tantalus*, Lin.).—

Have the feet, nostrils, and beak of the Storks, except that the ridge of the latter is rounded, and its tip gradually curved downwards, and slightly emarginated on each side: a portion of the head, and sometimes of the neck, is bare of feathers.

The Wood Ibis of North America (*T. loculator*, Lin.).—As large as a Stork, but more slender; white, with the quill and tail-feathers black, as is also the naked skin of the head and neck. It is found in both Americas, appearing in each during the rainy season, and frequents muddy waters, where it seeks principally for Eels. Its gait is slow, and general aspect unliely.

The African species (*T. ibis*, Lin.), which is white, slightly shaded with purple on the wings, and has a yellow beak, and the naked skin of the visage red, was long regarded by naturalists as the bird so revered by the ancient Egyptians under the name of *Ibis*; but recent researches have proved that the real *Ibis* is a much smaller species, which we will notice presently. The bird now under consideration is not even commonly found in Egypt, but is brought chiefly from Senegal.

That of Ceylon (*T. leucocephalus*) is the largest of all, and has also the thickest bill. Its beak, and the naked skin of the face, are yellow, the plumage white, with black quills and cincture round the breast, and long roseate plumes on the croup, which are shed during the rainy season. A fourth may be added, the *T. lacteus* of Temminck.

THE SPOONBILLS (*Platalea*, Lin.)—

Approximate the Storks in their whole structure, but their beak, from which their name is derived, is long, flat, and broad throughout its length, widening and flattening more particularly at the end, so as to form a round spatula-like disk; with two shallow grooves extending its entire length, without being exactly parallel to its edges. The nostrils are oval, and pierced at a small distance from the origin of each groove. Their minute tongue, reticulated tarsi, the somewhat considerable palmature of their toes, their two very small cæca, but slightly muscular gizzard, and inferior larynx without any peculiar muscles, are the same as in the Storks; but the expansion of their bill deprives it of all its strength, and unfits it for any thing but turning up sand, or picking up small fish and aquatic insects.

The White Spoonbill (*Pl. leucorodia*, Gm.).—Entirely white, with an occipital crest. It is common throughout the ancient continent, and nestles in high trees. [The trachea normally undergoes in both sexes a small convolution resembling the figure 8, but we have dissected one female wherein it proceeded straight to the divarication of the bronchi, and was furnished with a small pair of muscles].

The Roseate Spoonbill (*Pl. ajaja*).—A naked visage, and vivid roseate tints of different shades upon the plumage, which deepen with age. It is properly an inhabitant of South America.

The family of

LONGIROSTRES

Consists of a multitude of Shore-birds, the greater number of which were comprehended by Linnæus in his genus *Scolopax*, and the rest confounded by him in that of *Tringa*, though partly in opposition to the character assigned to the latter, of having the back-toe too short to reach the ground. Lastly, it contains a few that have been placed with the Plovers, on account of the total absence of the hind toe. The whole of these birds have nearly the same conformation, the same habits, and most frequently the same distribution of colours, which render it difficult to distinguish between them. They are generally characterized by a long, slender, and feeble bill, which only permits them to bore in the mud in search of worms and small insects; and the various slight modifications in the form of this beak enable us to arrange them into genera and subgenera.

[We should observe that the distinction between this group and the *Pressirostres* is extremely vague, or rather, with certain reservations, that they compose but one series, plainly characterized by their anatomy. The sternal apparatus of the Knot Sandpiper (fig. 119.) may serve

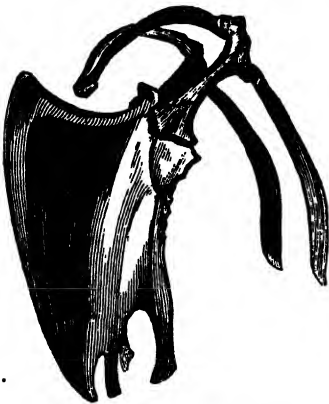


Fig. 119.—Sternum of the Knot Sandpiper.

as a specimen of this portion of the skeleton throughout the whole, the few modifications which occur of it being inconsiderable. The stomach (save in the Bustards and Coursers, which in other respects are the least conformable among them), is always a muscular gizzard, and the intestines long, with small or moderate cæca, and invariably a distinct cæcal remnant of the umbilical vessel. The females (except in the very few species of polygamous habit), are larger than the males, and they almost invariably lay four eggs on the ground, upon little or no nest, and dispose them with the small ends inwards; the young following their parents as soon as they burst the shell].

According to his own principles, Linnæus should have classed most of these birds in his great genus of

THE SNIPES (*Scolopax*),—

Which we divide as follows, from trivial variations of the form of the bill.

THE IBISES (*Ibis*, Cuv.).

We separate these from the *Tantali* of Gmelin, on account of their beak, which, though arcuated as in

the latter, is much more feeble, and devoid of emargination at the tip; besides which the nostrils, pierced towards the back and base, are prolonged in a groove which reaches to the end. This beak is also tolerably thick, and nearly square at the base, and some parts of the head or even of the neck are always bare of feathers. The external toes are considerably palmated at base, and the thumb sufficiently long to bear upon the ground. [The gradation is, in fact, quite imperceptible from these to the

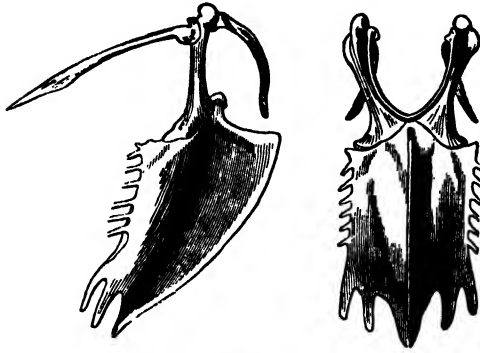


Fig. 120.—Sternum of Glossy Ibis.

Tantals, and the anatomy and character of the plumage concur to show that both naturally pertain to the preceding division of *Cultrirostres*: we believe the Ibises also build in society upon trees; and there is certainly no trace of a passage from them into the *Scolopaceous* birds.] Some of them have short and reticulated legs; and these are also more robust, and have a thicker bill.

The Sacred Ibis (*I. religiosa*, Nobis; *Abou Hannè*, Bruce; *Tantalus Æthiopicus*, Latham), is the most celebrated species. It was reared in the temples of ancient Egypt, with a degree of respect bordering on adoration; and was embalmed after its death. This arose, according to some, from its devouring serpents, which would otherwise have

multiplied to a noxious extent in the country; while others are of opinion that it took its origin from some relation between its plumage and one of the phases of the moon; a third class ascribing it to the fact that its appearance announced the overflow of the Nile. For a long while, the African Tantal was believed to be the Ibis of the Egyptians, which is now ascertained to be a species of the division we are now treating of, the size of a Fowl, with white plumage, excepting the tips of the quill-feathers, which are black; the greater coverts [tertiaries] having elongated, slender, and loose barbs, of a black colour with violet reflections, and covering the extremities of the wing and tail. The beak and feet, together with the naked part of the head and neck, are black; and the latter clothed, in the young, at least the upper surface, with short black feathers.\* It is found throughout Africa.

Other Ibises have scutellated tarsi, and generally a more slender bill.

The Scarlet Ibis (*Scol. rubra*, Lin.; *Tantalus ruber*, Gm.).—Remarkable for its bright-red colour all over, except the black tips of its wings. The young are at first covered with blackish down, becoming then ash-coloured, and whitish when they begin to fly: in two years the red makes its appearance, the brilliancy of which increases with age. It is found in the hot parts of America, and lives in marshy districts in the vicinity of estuaries; does not migrate, and is easily rendered domestic.

The Glossy Ibis (*Sc. falcinellus*, Lin.).—Body empurpled rufous-brown, with a deep green mantle; the young with the head and neck speckled with whitish. A resplendent species of the south of Europe and north of Africa, and probably that designated *Black Ibis* by the ancients. [It occurs rarely in the British Isles.]

#### THE CURLEWS (*Numenius*, Cuv.).—

Have an arcuated bill like that of an Ibis, but more slender, and round throughout; the tip of the upper mandible passing beyond that of the lower, and bulging a little downwards in front of it. The toes are palmated at base.

The Whaup Curlew (*Sc. arcuata*, Lin.).—Size of a Capon, and brown, with the margins of all the feathers whitish; the croup white, and tail barred white and brown. It is tolerably good eating, and common along our coasts, and as a bird of passage in the interior, [breeding in the upland moors of Britain: its plaintive whistle is well known along the sea-side, and has given rise to its name.]

The Whimbrel Curlew (*Sc. phaeopus*, Lin.).—One half smaller, with nearly similar plumage. [Is not quite so common in Britain as the last, and breeds sparingly on our most northern hills. There are several others.]

#### THE SNIPES, properly so called, (*Scolopax*, Cuv.).—

Have a straight bill, with the nasal grooves extending nearly to the tip, which expands a little externally to reach beyond the lower mandible, on the middle of which there is a simple furrow. The tip of the bill is soft and very sensitive, and drying after death presents a punctured surface. The feet are devoid of any palmature. A peculiar character of these birds consists in the compressed form of the head, and the backward site [at least in the larger species, with shorter tarsi], of their large eyes, which imparts a singularly stupid air, in conformity with their habits.

\* We believe that all birds which have any naked parts in the adult state, have invariably the same feathered when young.—Ed.

[They fall into two natural subdivisions: the first that of the Woodcocks, with less slender form, shorter legs, and the tibia feathered to the joint; colour resembling that of decayed leaves.]

The European Woodcock (*Sc. rusticola*, Lin.).—Universally known, with handsomely mottled plumage. In the summer it inhabits high mountains, and descends into the woods in the month of October, where it is generally met with singly or in pairs, particularly in dull weather, and feeds on worms and insects. A few remain in the level country throughout the year.

[The Snipes, commonly so called, are lighter-made, with longer legs, and tibia bare above the joint. They frequent marshy districts, and are coloured in adaptation to their abode.]

In Britain, we have three species, very similar in their colouring,—the Great or Double Snipe (*Sc. major*), which approaches in form to a Woodcock, and is only met with in the seasons of passage; the Common or Whole Snipe (*Sc. gallinago*), which breeds in considerable numbers on the northern hills, and is everywhere common in marshy districts during the winter; and the Half or Jack Snipe (*Sc. gallinula*), a minute species, more richly coloured than the preceding, with much less tail: a fourth, the Sabine's Snipe (*Sc. Sabini*), is extremely rare, and exceeds the Common Snipe in size, having dingy plumage, with no white upon it. All are highly esteemed for the table.]

We should distinguish from the other Snipes

The Grey species (*S. grisea* and *Novboracensis*: [*Macroramphus griseus*, Leach], which is in truth a *Tringa* with a longer bill than usual, similar to that of the Snipes, and retains the gregarious habits and seasonal changes of colouring of the true Sandpipers and Godwits.) Its front toes are semipalmated. This bird is common in North America and occurs as a rare straggler on this side of the Atlantic.

#### THE RHYNCHEANS (*Rhynchæa*, Cuv.)—

Are African and Indian birds, the mandibles of which are nearly equal, a little arched at the end, with the nasal grooves extending to the tip of the upper one, which has no third furrow. Their toes are not palmated. To the port of the Snipes, they conjoin more vivid colours, and are particularly remarkable for the ocellated spots which adorn the quill-feathers of their wings and tail.

They are found of different medley of colour, which Gmelin brought together as so many varieties of one species (*Sc. capensis*), and which Temminck also believes to be the same at different ages. One perfectly distinct has, however, been received from Brazil (*Rh. hilearea*, Val.)

#### THE GODWITS (*Limosa*, Bechst.)—

Have a straight bill, sometimes a little arcuated upwards, and still longer than in the Snipes, the nasal groove extending almost to the tip, which is rather soft and depressed, but without additional furrow, or punctuation. The external toes are palmated at base. Their form is much more attenuated, and legs considerably more elevated, than in the Snipes, and they frequent salt marshes and the shores of the ocean [changing to rufous on the under-parts and partially above in the breeding season, as in many Sandpipers, to which their gregarious habits are more nearly related than to those of the Snipes.]

Two species are not uncommon on the British shores, viz., the Bar-tailed Godwit (*L. rufa*), which breeds more to the north, and abounds during the seasons of passage, and throughout the winter; and the Black-tailed Godwit (*L. melanura*), which is much taller, with a longer bill, and (in old specimens) a pectinated middle claw; the distal half of its tail is black, and it does not acquire so bright a rufous in the spring. This bird breeds in the British marshes, and can pick up and subsist on barley, upon which numbers are fed that are brought from Holland to the London markets. There are several others.]

#### THE SANDPIPERS (*Calidris*, Cuv.; *Tringa*,\* Tem.)—

Have the tip of the beak depressed, and the nasal furrow very long, as in the Godwits, but the mandibles in general are not longer than the head; their toes, slightly bordered, have no palmation at the base, and the back-toe hardly reaches to the ground; their legs but moderately elevated, and abbreviated form, impart a heavier carriage than that of the Godwits. Their size also is much smaller. [The author separates his group *Pelidna*, merely on the character of having the beak a trifle longer than the head, a difference which in several species depends merely on age or sex; the females of all the present family having a proportionally longer beak than the males, besides exceeding them a little in stature.]

Numerous species are found, more or less regularly, on the British shores: the principal of which are—the Knot Sandpiper (*Tr. canutus*), the size of a Snipe, and ashy-grey above, white below, with some dusky spots on the breast in winter, suffused with bright ferruginous in the spring; bill short and straight; it is a common species, and occurs in large flocks during the seasons of passage and through the winter, retiring further north to breed. The Purple Sandpiper (*Tr. maritima*), is smaller and less gregarious, and prefers rocky shores; back empurpled, the feathers margined with greyish during the winter. The rest are placed by the author in his *Pelidna*. The Purple Sandpiper (*Tr. variabilis*), still smaller, with a rather longer and more arcuated bill, coloured in winter like

the first, and mottled with rufous above, and a black patch across the breast, in the breeding season: it is the commonest of all, and some breed on the upland moors. The Curlew Sandpiper (*Sc. subarquata*, Gm.; *Numenius africanus*, Lath.), resembles the Knot in colouring and seasonal changes, and the Purre in size, with a still longer and more-arcuated bill; it is not common, nor very rare, on the British shores. The Little Sandpiper (*Tr. minuta*) is considerably less than the last, with a short bill; it acquires some rufous tints in the spring, on the upper parts and across the breast, and is certainly rare, though very much overlooked. Three or four others occur as stragglers. These active-little birds take their food along the margin of the sea, following each retreating wave; when gregarious in considerable flocks, and in their winter plumage, the whole show alternately their grey upper parts and white lower parts as they whirl in the air, producing a remarkable appearance, well known to those accustomed to wander by the sea side.]

#### THE SANDERLINGS (*Arenaria*, Bechst.; *Calidris*, Vigors)—

Merely differ in the absence of hind-toe, like the Plovers.

One only is known (*Charadrius calidris*, Gmelin), the size of a Purre, with analogous seasonal changes to those of the Knot Sandpiper. [It appears to be almost generally diffused, and is common on the British shores.]

#### THE FALCINELLES (*Erolia*, Vieillot)—

Have the beak rather more arcuated than in the Curlew Sandpiper, but do not, as has been asserted, want the thumb.

We are acquainted with one only, (*Sc. pygmaea*, Lin.), a bird proper to Africa, but which is occasionally found in Europe.

#### THE RUFFS (*Machetes*, Cuv.)—

Are true Sandpipers by the bill and feet, except that the palmature of their outer toes is nearly as considerable as in the Gambets, Godwits, &c.

One species only is known (*Tr. pugnax*, Lin.). Larger than a Snipe, and very celebrated for the furious combats which the males wage in spring for the possession of the females. At this epoch, the head becomes partly covered with red [or yellow] papillæ, and the neck is furnished with a very considerable collar or ruff of lengthened feathers, so variously marked and coloured in different individuals, that two can hardly ever be found alike, and rarely much resembling each other. They have always yellow legs\*, which, together with the semi-palmation of the toes, assists us to recognize them at all seasons. The species is common in the north of Europe, [and is remarkable for the male exceeding the female in size, at variance with the other members of this group, but in accordance with its polygamous habits. Vast numbers are brought from Holland to the London markets.]

America produces some species nearly allied, as the *Hemipalmus*, Bonap.; or *Tringa semipalmata*, Wilson; [the habits of which are more allied to those of the Gambets, to which in fact they essentially belong].

Near the Sandpipers should apparently be placed

#### THE SPATHE-BILL (*Eurynorhynchus*, Wilson),—

Which is distinguished by a depressed bill, widened at the tip somewhat as in the Spoonbills, and the only species of which is

The *Platalea pygmaea*, Lin.; *Eurynorhynchus griseus*, Wilson (*Thun. Acad. Suec.*, 1816, pl. vi), which is one of the rarest birds in existence, as it is only known by a single individual, grey above and white beneath, and about the size of a Purre Sandpiper. [It has since been met with in northern Asia.]

#### THE PHALAROPES (*Phalaropus*, Brisson),—

Are small birds, the bill of which, more flattened than in the Sandpipers, is otherwise similar as regards its proportions and lateral grooves, and the toes of which are bordered with very broad membranes, as in the Coots. [Their lower plumage resembles in texture that of the Gulls.]

The known species (*Tr. lobata* and *Tr. fulvicaria*, Lin.), has a wide bill for a member of this family, and is in winter ash-coloured above, whitish below and on the head, with a black band upon the neck: it is then the *Grey Phalarope* (*Tr. lobata*, Edw.). In summer it becomes black, mottled with fulvous above, and of a deep reddish below [like the Knot Sandpiper, Godwits, &c.]: but at all seasons it retains a white spot on the wing, the rest of which is blackish. It is then the *Red Phalarope* (*Ph. rufus*, Bechstein and Meyer; *Tr. fulvicaria*, Lin.). This bird is rare in Europe [not very so in the British Isles, during the season of passage, when individuals are occasionally met with swimming upon inland ponds, like a very diminutive Duck, and evincing little fear or shyness: they also occur in small flocks, and breed chiefly within the Arctic circle].

#### THE TURNSTONES (*Streptilas*, Illiger),—

Are rather lower on the legs, and have a short bill, and toes devoid of any palmature, like the true Sandpipers; but their beak is conical, pointed, and without depression, compression, or inflation, and the nasal groove reaches only half-way. The thumb barely touches the ground. Their beak, rather

\* This is very far from being the case.—Edw.



stouter and proportionally less flexible than in the preceding, is used by them to turn over stones to search for the worms that lie beneath them. [Its form is not unlike that of a Nuthatch's bill.]

The two species doubtfully indicated by the author are merely the same in different states of plumage: it is a bird of remarkably wide geographic range, and tolerably plentiful on the British coasts: its affinity is rather with the Oyster-catchers and Plovers.]

#### THE GAMBETS (*Totanus*, Cuv.)—

Have a slender, round, pointed, and solid beak, the nasal groove of which only extends half its length, and the upper mandible is slightly arcuated towards the tip. Their form is slight, and legs elevated: the thumb hardly touches the ground, and the palmation of their outer toe is well-marked. The species are each found nearly all over the world, [or rather, there are many difficult of determination apart, which has induced the latter opinion.]

The Greenshank Gambet (*Scol. glottia*, Lin.).—As large as a [rather small] Godwit, with the beak comparatively stout, [and a little recurved]; ashy-brown above and on the sides, with the margins of the feathers punctuated with brown, the croup and belly white, and tail rayed with narrow irregular bars grey and white; the feet green: in summer the throat and breast are spotted with dusky tears, which disappear after the breeding season. This is the largest species of Gambet in Europe. [It breeds on the margins of lakes, including those of Britain, and during the season of propagation is very clamorous, rising on the wing and spreading an alarm at the approach of danger to all other birds within hearing: in winter it resorts to the sea-shore in small flocks, apparently the amount of broods. The Greenshank is a characteristic example of a particular group, the members of which are comparatively large, acquire more or less of a dusky colour on the under-parts towards the breeding season, and agree in their general habits, mostly frequenting fresh-water lakes. An allied species of North America (*Tot. semi-palmatus*) has the toes half-webbed, and has been known to occur in Europe as a straggler. The Dusky Gambet (*T. fuscus*) is another European species, more delicately formed, with particularly slender beak and feet, and beautifully barred tail and coverts, which becomes entirely suffused on the under-parts with fuliginous-black in the spring, and is rare in Britain. A fourth (*T. calidris*), the Redshank Gambet, is very abundant in Britain, breeding also not uncommonly in marshes near the sea-shore, and especially about the estuaries of rivers.

Others acquire no colour on the under-parts in spring, and mostly breed in the marshes, where they trip across the broad floating leaves of aquatic plants with grace and agility: such are, particularly, those with longer legs, as the delicate Wood Gambet (*T. glareola*), which is sometimes found in Britain, the *T. stagnatilis*, Bechst., of eastern Europe, and *T. chloropygius* of North America: one more common in this country, with shorter legs, and a conspicuous white rump as it flies, is the Green Gambet (*T. ochropus*), which conducts into the next minor group.

The others, at least those of Europe, are still smaller, and familiarly known as *Summer Snipes* in England. One very common may be termed the Common Gambet (*T. hypoleucos*), which in America is represented by a species with a breast spotted like that of a Thrush (*T. macularia*). Another in Europe, still more diminutive (*T. teminckii* or *pusilla*), has been generally classed with the Sandpipers, but strictly appertains to the present group both in structure and habits, being never found on the sea-shore, but frequenting inland waters like its true congeners, all of which jerk the tail and nod the head frequently as they run about, and emit a clear whistling note. There are many others in foreign parts.]

#### THE LOBEFOOT (*Lobipes*, Cuv.)—

Which we consider ought to be separated from the Phalaropes, which it resembles in the lobation of its toes, is distinguished from them by its bill, which is that of a Gambet. Such is

The Red-necked Lobefoot (*Tringa hyperborea*, Lin.).—A little bird, grey above, white below, tinted with rufous on the scapularies, and having a broad red gorget round its white throat. Add the *Phalaropus frenatus*, Vieillot; or *Holopodius [Wilsoni]* of M. C. Bonaparte, [which is found in America generally. The first-named species breeds in the northern isles of Scotland, inhabiting marshy grounds, where it cannot be obtained without much difficulty, though far from being timid in its disposition].

#### THE STILTS (*Himantopus*, Brisson)—

Have a round beak, slender and pointed, even more so than in the Gambets; the grooves of the nostrils extending only half-way. But what particularly distinguishes them, and has given origin to their name, is the inordinate length and slenderness of their legs, which are reticulated and destitute of hind-toe, and the bones of which are so feeble as to render walking painful to them.

But one species is known in Europe (*Charadrius himantopus*, Lin.; [*H. Plinii*, Auct.]; which is white, with a black calotte and mantle, and long red legs. It is rather rare, and little is known of its manners. [The latter



Fig. 121.—The Stilt

bear a near resemblance to those of the Avocets, with which this genus is even linked by an intermediate species, which conjoins the webbed toes of the latter with the beak of the Stilts (the *H. palmatus*, Gould, a native of Australia). There are three or four normal species, and both this and the next genus are almost generally diffused, frequenting muddy estuaries in winter, and salt-marshes during the season of propagation].

We can scarcely place otherwise than here

#### THE AVOCETS (*Recurvirostra*, Lin.),—

Although their feet, which are webbed nearly to the ends of their toes, almost entitle them to rank among the Swimming-birds; but their lengthened tarsi and half-naked tibiae, their long, slender, pointed, smooth, and elastic bill, and the mode of life which results from their conformation, concur to approximate them to the Snipes. What particularly characterizes them, and distinguishes them even from all other birds [if two remarkable species of Humming-bird be excepted, the *Trochilus recurvirostra* and *Tr. avocetta*], is the strong upward curvature of their beak, [the mandibles of which have often been compared to two thin slips of whalebone]. Their legs are reticulated, and thumb too short to reach the ground.

That of Europe (*R. avocetta*, Lin.) is white, with a black calotte and three bands of the same upon the wings, and leaden-coloured legs. It is a handsome bird, of attenuated form, which frequents the sea-shore in winter, [where it feeds by *scooping* (as it is termed), with its singular bill, drawing this through the mud or sand from right to left as it advances its left leg foremost, and *vice versa*, seizing whatever living prey is thus met with. Its manners in the breeding season resemble those of the Gambets, rising on wing and emitting its cry at the approach of any intruder; it collects, however, a greater quantity of nest than is usual among the wading-birds, the majority of which pertaining to the present group merely lay in some slight hollow. There are three or four other species].

The family of

#### MACRODACTYLI

Are furnished with very long toes, adapted for traversing aquatic herbage, or even for swimming, in those numerous species which have them bordered, [and not these only]. There are no membranes, however, connecting the bases of their toes, not even the two outer ones. The beak, more or less laterally compressed, is lengthened or shortened according to the genus, without ever attaining the degree of feebleness and attenuation which is characteristic of the preceding family. The body of these birds is also singularly compressed, a conformation

resulting from the narrowness of the sternum (fig. 122); their wings are short or moderate, and their flight feeble. [The females are mostly larger, and in some instances excel the males in brightness of colouring; and they produce numerous speckled eggs, having a reddish clay ground-colour, the young running soon after they are hatched, being then covered with a rigid, black, hair-like down: their cry is generally abrupt and croaking].

They have been divided into two tribes, according to the presence or absence of any armature on the wings; but this character is subject to exception.

#### THE JACANAS (*Parra*, Lin.).—

Are conspicuously distinguished from all other Stilt-birds by the extraordinary length of their four toes,

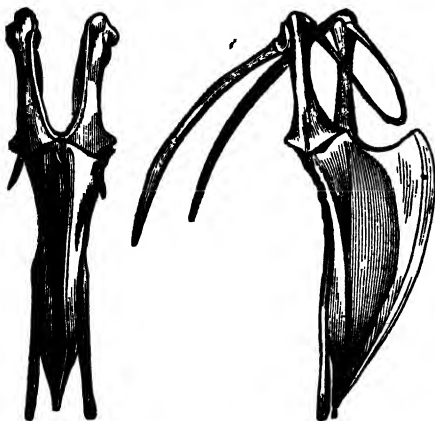


Fig. 122.—Sternum of Corn Crake or Land Rail.

which are separated to the base, and the claws of which, more particularly that of the back-toe, are extremely long and sharp-pointed. The bill resembles that of the Lapwings by its medium length and slight bulge towards the tip, and the wing is armed with a spur. They are noisy and quarrelsome birds, which reside in the marshes of hot climates, where they walk with facility on the floating leaves of aquatic plants, by means of their long toes. [They are essentially modified, however, upon the type

of the preceding group, which is traceable in their whole anatomy; and are nearly allied to certain Lapwings, which we believe they also resemble in the number and character of their eggs.]

America produces some species which have a flat naked membrane at the base of the bill, which is reflected over part of the forehead. As

The Common Jacana (*P. jacana*, Lin.).—Black, with a rufous mantle; the primary wing-coverts green; and fleshy wattles under the beak. It is the commonest of those inhabiting the hot climates of America, and has very sharp spurs.

Some of the same kind are found in Asia, as

The Bronzed Jacana (*P. anea*). The body black, changing to blue and violet, a bronzed-green mantle, blood-red croup and tail, the anterior wing-feathers green, and a white streak behind the eye. Its spurs are small and blunt.

Others have been discovered in the east in which this membrane does not exist, and which are otherwise remarkable for some singular differences in the proportions of their quill-feathers. As

The Long-tailed Jacana (*P. sinensis*).—Brown, with the head, throat, fore-neck, and wing-coverts, white, the hind-neck adorned with silky feathers of a golden-yellow colour, and a small pedicellated appendage to the tips of some of the quill feathers.

There is one also in the east which is crested, and has no spurs to the wings, (the *P. gallinacea*, Tem.).

#### THE SCREAMER (*Palamedea*, Lin.).—

Resembles the Jacanas, but on a very large scale, by the two stout spurs which it bears on each wing, and by its long toes and strong claws, more particularly that on the hind-toe, which is long and straight as in the Larks; but its beak, which is slightly cleft, is neither much compressed nor bulging, and its upper mandible is a little arcuated. The legs are reticulated.

The species known, the Horned Screamer (*P. cornuta*), termed in Brazil *Anhima*, and *Camouche* in Cayenne, is larger than a Goose, and blackish, with a rufous spot on the shoulder, the top of its head bearing a singular ornament, consisting of a long and slender, moveable, horny stem. Its toes have no palmation. This bird inhabits the inundated grounds of South America, and its very loud voice is heard afar off. It is strictly monogamous: is said to pursue reptiles; but although its stomach is only slightly muscular, it scarcely feeds on any thing but aquatic herbage. [The trachea of this bird has an abrupt bony box or enlargement about the middle, somewhat analogous to that of the male Velvet Pochard (*Oidemia fusca*)].

A distinct genus has been made of

#### THE CHAUNA (*Opisthophus*, Vieillot).—

Which has no horn on the vertex, but the occiput is adorned with a circle of erectile feathers. The head and upper part of the neck are only covered with down, and it has a black collar. A singular phenomenon is exhibited by the circumstance of its skin, even that covering its legs, being inflated by the interposition of air between it and the muscles, so that it crackles under the finger.

It is the *Parra chavaria*, Lin. The rest of its plumage is lead-coloured and blackish, with a white spot at the bend of the wing, and another at the base of some of the large primaries. There is a tolerably well-marked palmation between its external toes. It feeds principally on aquatic herbage; and the Indians of Carthagea rear some among their flocks of Geese and Poultry, as they deem it very courageous, and capable of repulsing even a Vulture.

Near to the Screammers we think should be placed, although they have scarcely any naked space above the tarsal joint,

#### THE MEGAPODES (*Megapodius*, Lesson).—

A genus recently discovered in New Guinea, with a vaulted beak, a little compressed, the membranous nostrils occupying about half its length, and very stout and elevated tarsi, which are scutellated, the toes (including the hind one) being long, and terminated by claws which are rather flat. They have a short tail, a naked space round the eye, and there is a small tubercle on the carpus, the first and slight vestige of the spur of the Screamer. The membrane between their external toes is very slight, while that of the inner is rather larger. They lay disproportionately large eggs for their size.

One species is crested nearly as in the Chauna (*M. Duperreyi*, Lesson): two others have no crest; and a fourth has scarcely any tail.

In the tribe wherein the wings are unarmed, Linnæus comprises, under the genus *Fulica*, all such as have the bill continued backward into a sort of shield, that covers the forehead; and those which do not possess this character he arranges in the genus *Rallus*.

THE RAILS (*Rallus*, Lin.),—

Which bear, in other respects, a very strong mutual resemblance, have bills of very different proportions.

Among the species in which it is longest,

THE RAILS (*Rallus*, Bechstein),—

May be first mentioned.

The European Rail (*R. aquaticus*, Lin.).—Olive-brown, marked with black above, bluish-ash-colour beneath, with some narrow black and white rays crossing the flanks. This bird is common in our ponds and ditches, where it swims well, and runs lightly upon the leaves of aquatic herbage, feeding on small Crustaceans. [Its frontal feathers are rigid, in place of the shield of the Coots and Gallinules. There are various others, all extra-European.]

Other species,

THE CRAKES (*Crex*, Bechstein),—

Have a shorter bill, as observed in

The Corn-Crake (*R. crex*, Lin.).—Of a reddish-brown colour, marked with blackish above, and greyish below, with dull black rays crossing the flanks; the wings rufous. It lives and nestles in our fields and meadows, and runs with great swiftness among the long grass. The Latin name, *Crex*, is expressive of its cry. It feeds on corn, in addition to worms and insects.

[The following species, or

THE SORAS (*Zapornia*, Stephens),—

Have an intermediate beak, and resemble the Rails in their aquatic habits.]

The Speckled Sora (*R. porzana*, Lin.).—A deep brown, speckled with white, and whitish rays on the flanks. It is a good swimmer and diver, and does not leave France till the middle of winter. [There are two smaller kinds in western Europe, including the British Isles; the Baillon's Sora (*Z. Baillonii*), with somewhat speckled plumage; and the Little Sora, as it is termed, though surpassing the last in size, (*Z. pusilla*), the plumage of which approximates that of the Common Rail. Of various exotic species, some are considerably larger than the Crake and Rail of Europe].

THE COOTS (*Fulica*, Lin.)—

May be subdivided in the following manner, according to the form of the beak, and the membranes margining the toes.

THE GALLINULES (*Gallinula*, Briss. & Lath.)—

Have the beak nearly as in the Crakes, but distinguished by the frontal shield, and by longer toes, bordered with a narrow membrane.

The Common Gallinule (*G. chloropus*, Lin.).—Deep olive-brown above, slaty-grey below, with some white on the sides, [the feet green, with a red and yellow cincture above the tarsal joint, and the frontal shield bright red: these lively colours being much more conspicuous in the female, which is larger also than her mate. A very common species throughout Europe, and considered to be of universal diffusion, as specimens from the most distant regions are undistinguishable].

THE SULTANAS (*Porphyrus*, Brisson)—

Have the beak higher in proportion to its length; and very long toes, with scarcely any perceptible border; the frontal shield considerable, and rounded in some, square above in others. These birds stand on one foot, while they employ the other to convey food to the beak. Their colours are generally fine shades of violet, blue, and azure. Such is

The Common Sultana (*Fulica porphyrio*, Lin.), a beautiful African species, now naturalized in several islands and countries bordering the Mediterranean. Its beauty would render it an ornament in our parks.

Lastly,

THE RESTRICTED COOTS (*Fulica*, Brisson)—

Conjoin to a short beak and large frontal shield, toes that are much widened by a festooned border, which renders them excellent swimmers; hence their lives are passed in pools and marshes. Their smooth plumage is not less adapted than the rest of their conformation to this mode of life, and they consequently exhibit a marked transition from the Wading to the True Swimming Birds, [though only in superficial or adaptive characters, which are principally external].

There is one in Europe (*F. atra*, *aterrima*, and *athlops*, Gm.).—[Slaty-black, darker on the neck, with a flesh-coloured shield, which becomes white in the season of propagation. It is very easily tamed, and subsists on grain, pond-weed, and even small fish, diving with facility.]

We terminate this series of Stilt-birds by three genera, which it is difficult to associate with any others, and which may be considered as each forming a separate family.

THE SHEATHBILLS (*Chionis*, Forster).—

Have short toes, nearly as in the Poultry, the tarsi scutellated, the beak thick and conical, and enveloped at base by a hard substance, which, it appears, the bird has the power of raising and depressing.

We are acquainted with only one species, from New Holland (*Ch. necrophaga*, Vieillot), the size of a [large] Partridge, and entirely white. It frequents the sea shore, and feeds on dead animal matter thrown up by the tide. [Prof. Blainville has lately shown that this remarkable bird approaches very near to the Oyster-catchers in its whole anatomy, and the affinity is discernible on comparison of their external characters.

Apparently allied are

THE ATTAGENS (*Attagus*, d'Orb.).—

The uncompressed bill of which nearly resembles that of a Poultry-bird, and the plumage is not unlike the immature dress of a Lark : wings and feet as in *Chionis*.

Several species inhabit the Cordilleras of the Andes, varying in size from that of a Partridge to less than a Lark. The smaller constitute the *Tinocorvus* of Vieillot.]

THE PRATINCOLES (*Glareola*, Gmelin).—

Have a short, conical beak, arcuated throughout, and resembling that of a Poultry-bird. The wings excessively long and pointed, and tail often forked, producing the flight of a Swallow or Petrel. The legs are of mean length, the tarsi scutellated, the external toes a little palmated, and thumb reaching to the ground ; [middle claw furnished with an obtusely serrated inner edge]. They fly in troops, and cry about the borders of water, subsisting on aquatic insects and worms. [Their sternal apparatus and anatomy intimate their position to be among the Snipes and Plovers.]

The European species (*Gl. torquata*) is brown above, white below and on the croup ; the gorget encircled with a black marking ; and base of the bill and feet reddish. It appears to inhabit the north of the whole ancient world.

Our last genus consists of

THE FLAMINGOES (*Phenicopterus*, Lin.).—

Which are among the most extraordinary and isolated of birds, [being, in fact, an extreme modification of the Lamelli-rostral type, that is, of the Duck tribe, with inordinately elongated neck and legs]. Their legs, of excessive length, have their front toes palmated to the ends, and an extremely short hind-toe ; the neck is equally long and slender with the legs, and their small head is furnished with a bill the inferior mandible of which is of an oval form, longitudinally bent into a semicylindrical canal, while the upper one, oblong and flat, is bent crosswise in the middle, so as to join the other exactly. The membranous groove of the nostrils occupies nearly the whole side of that part which is behind the sudden bend of the mandibles, and the nostrils themselves form a longitudinal slit at the base of the groove. The edges of the two mandibles are furnished with small and very fine transverse laminae, which, together with the fleshy thickness of the tongue, imports some relationship with the Ducks. We might even place the Flamingoes among the *Palmipedes*, were it not for the length of their tarsi, and the nudity of part of the tibia, [an objection which would equally apply to the Gulls and Petrels]. They feed on Testaceans, Insects, and the spawn of Fishes, which they seize by means of their long neck, reverting the head to employ with advantage the crook of the upper mandible. They construct their nest of earth in marshy situations, placing themselves astride of it [?] during the act of incubation, in consequence of the extreme length of their legs incapacitating them from sitting in the usual manner. [The digestive organs resemble those of the Ducks with unlabeled hind-toe ; having even the *crop*, or distension of the œsophagus, which occurs in no species strictly belonging to the division of Stilt-birds.]

The common species (*Ph. ruber*) stands from three to four feet in height, and is ash-coloured, with brown streaks, during the first year ; in the second there is a roseate hue on the wings, and in the third it assumes a purple red on the back, and rose-coloured wings. This species is found in all parts of the eastern continent below 40 degrees. Numerous flocks are seen every year on the southern coasts of Europe, and they sometimes ascend as far as the Rhine.

M. Temminck thinks [and has since definitely ascertained] that the American Flamingo is distinct ; besides which, there is a small species on that continent (*Ph. minor*, Vieillot) of which the Pigmy Flamingo of Temminck is the young.

[Here, at the close of the great series of *Ground-Birds*, as of the *Perchers*, may be introduced a few brief remarks on the classification of these animals, as warranted by the present state of information. The divisions are not all so strongly characterized apart as the four principal groups or orders already specified; but chiefly because certain genera stand forth from the rest, and will not (so far as we can perceive at present) satisfactorily range with any of the others. Preserving the same form of nomenclature as before adopted, as less objectionable than any other that we can devise, the various groups of Ground-birds (as the vast majority of the foregoing extensive series may be appropriately denominated,) fall into six principal divisions, which may be designated as follow:—

V. GEMITORES (*Cooers*)—the Pigeons; an order strongly characterized by the whole internal anatomy, and not less so by the outward conformation. It is perfectly distinct from the contiguous orders, to which it is linked by no intrinsically connecting species.

VI. RASORES (*Ground-scratchers*)—the Poultry: a group sufficiently cognizable in its totality, but not easy to subdivide in such a manner as to exemplify the relative value of its various genera.

VII. CURSORES (*Runners*); or the *Brevipennes* of Cuvier.

VIII. CALCATORES (*Stampers*); or the *Pressirostres* and *Longirostres* of our author, comprising the numerous genera with soft and flexile bills, more or less prolonged, the greater number of which lay four eggs, which they dispose crosswise, &c. &c. The name alludes to the habit which many of them display, of stamping with the foot, to cause the worms on which they feed to rise.

IX. GRADATORES (*Stalkers*); or the *Cultriostres* of Cuvier.

X. LATITORES (*Skulkers*); or the *Macroductyli*.

Each of these appears to us to constitute a distinct and natural order, possessing various distinguishing characters; and we suspect that every genus of Ground-birds will ultimately prove, when its characters have been sufficiently studied, to rank in one or another of them. As a whole, they form a series, analogous to those of the *Perchers* and *Swimmers*.]

## THE SIXTH ORDER OF BIRDS,—

### THE PALMIPEDES,—

Have the feet organized for swimming; that is to say, placed far backwards on the body, with short and compressed tarsi, and webbed toes. They are further characterized by a close and polished plumage, impregnated with oil, and by a quantity of down next to the skin, which protect them from the water in which they pass most of their lives. They are the only birds in which the neck is longer than the legs, which is sometimes the case to a considerable extent, for the purpose of enabling them to search for food in the depths below, while they swim on the surface. Their sternum is very long, affording a complete guard to the greater portion of their viscera, and having on each side [generally] but one emargination, or oval foramen, filled up with membrane. They have most frequently a muscular gizzard, long cæca, and a simple inferior larynx; which last is in one family, however, inflated into a cartilaginous capsule. [So many exceptions occur to the foregoing generalization respecting the stomach and cæca, that it might advantageously have been omitted.]

This order subdivides tolerably well into four families, of which that of

#### THE DIVERS (*Brachypteres*)—

Presents, in certain of its species, some [very superficial] tokens of relationship with the Gallinules. The position of their legs, which is farther backward than in any other birds, renders walking difficult, and obliges them to maintain, when upon land, an upright attitude. As the

greater number of them are also feeble flyers, and several are quite deprived of that faculty, in consequence of the shortness of their wings, they may be regarded as exclusively attached to the surface of the water: their plumage is particularly dense, and its surface frequently polished, presenting a silvery lustre. They swim under water by the aid of their wings, which are employed as fins. Their gizzard is tolerably muscular; the cœca of moderate length. They have only one special muscle on each side of their lower larynx. Such are

THE LOONS (*Colymbus*, Lin.).—

Which are characterized by a smooth, straight, compressed, and pointed bill, with linear nostrils; but require to be subdivided from characters derived from the feet [the entire skeleton, character of plumage, propagation, &c. &c.]

THE GREBES (*Podiceps*, Latham; *Colymbus*, Brisson and Illiger).—

Instead of ordinary webs between the toes, have the latter widened as in the Coots, and the anterior connected only at base by membranes, [which border the remainder]. The claw of the middle toe is flattened; the tarsi exceedingly compressed. The semi-metallic [or satiny] lustre of their lower plumage has led to the occasional employment of it as fur. Their tibia, as also that of the Loons [in which it is much more produced,] is prolonged forwards beyond the joint, to give a more efficient insertion to the extensors of the leg. [Sternum (fig. 123)\* very short, and of peculiar conformation, approaching in some respects to that of the Cormorants; which these very singular birds also resemble in the character of their eggs, the hard shell of which is invested with an absorbent chalky substance. They have no vestige of a tail. The young are clad in exquisitely soft down, which is striped black and white, as in the Emu. The constant number of cervical vertebræ is nineteen instead of thirteen, as in the restricted Loons; and their skeleton is altogether extremely different.]

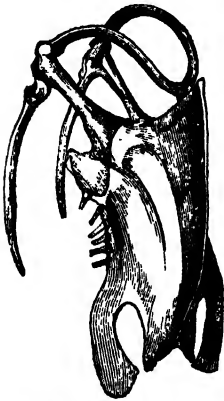


Fig. 123.—Sternum of Grebe.

These birds reside in lakes and ponds, and nestle among the rushes, [producing numerous eggs, whereas the Loons lay very rarely more than two]. It appears that under certain circumstances they carry their young under their wings. Their size and plumage change so much with age [the

latter rather according to season], that naturalists have very much multiplied the species. M. Meyer reduces those of Europe to four, [instead of five, which is the right number, as follow]:—

The Crested Grebe (*P. cristatus*).—As large as a Duck, and satiny-white, with dusky upper-parts, acquiring with age a double black crest, and rufous collar edged with black, [which exist only during the breeding season].

The Red-necked Grebe (*P. rubricollis*).—Smaller, with the neck bright rufous, and greyish collar less developed.

The Horned Grebe (*P. cornutus*) [and Eared Grebe (*P. auritus*).—Still less, and precisely of the same size with each other, so that they can only be distinguished, when the seasonal collar falls, by the beak of the second being distinctly a little recurved, and by a difference in the colour of the iris of the recent specimen; their collars, however, during the breeding season, are very different, and that of the Eared Grebe is less developed than in the other].

The Little Grebe (*P. minor*).—Size of a Quail, with never any crest or collar. [These various species, notwithstanding the shortness of their wings, can fly with considerable speed, when they once fairly rise, which they do with unwillingness, and seldom except when compelled to migrate. They can walk with their feet, and do not trail upon the belly, like the Loons; and when under water, they make more use of their wings than the latter do habitually].

THE FINFEET (*Heliornis*, Bonaterre; *Podoc, Illiger*)—

Have feet lobed as in the Coots and Grebes, but their tail is more developed than in either, and their claws sharper.

Such is *Plotus surinamensis*, Gmelin; and *Heliornis senegalensis*, Vieillot, which Gmelin approximated to the Anhingas.

THE LOONS (*Colymbus*, Latham; *Mergus*, Brisson; *Eudytes*, Illiger).—

With all the [external] form of the Grebes, have the feet webbed in the ordinary manner; that is to say, their three front toes are connected by membrane to the tips, and are all terminated by

\* The representation (fig. 123), in other respects accurate, is somewhat too long.—Ed.

pointed nails. They are northern birds, which rarely nestle with us, and visit these latitudes in winter, when they are not uncommon upon our coasts. [They have large wings, and fly strongly, but in consequence of the position of the feet, the tibia being quite buried within the integuments, are unable to walk, though they push themselves forward with facility and tolerable speed, trailing upon the belly. They have a short tail, on the tripod of which and the feet they are enabled to stand upright, and take a wide view around them by means of their long neck: they utter dismal howlings; and produce large spotted eggs, two or three in number, which are extremely unlike those of the Grebes.

Three species are well known, the whole of which are not rare in Britain. One, as large as a Goose (*Col. glacialis*), the Collared Loon, black above, beautifully spotted with white, with a nearly perfect collar of the same round the neck, and a black head. The second, (*C. glacialis*), the Black-throated Loon, extremely variable in size, but always smaller than the preceding, with a fuliginous grey head, and larger white spots on the upper parts: both of which species have the immature plumage dusky above, with greyish edgings to the feathers: and the Red-throated Loon (*C. septentrionalis*), still smaller and much commoner, the winter dress of which (and not the immature plumage, which resembles that of the others, is speckled above with numerous small whitish spots bordering the feathers, which wear off in spring, leaving the back spotless blackish; coincident with which change of appearance, a rufous patch appears in front of the neck. All three are great destroyers of fish, and proceed with extreme swiftness under water, in general making little use of their wings to assist their progress. They are common to the northern regions of both continents, as are also the four first-mentioned Grebes.]

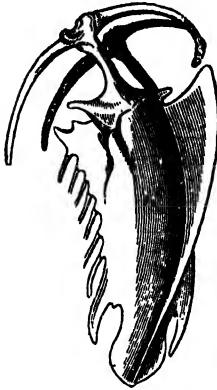


Fig. 124.—Sternum of Loon.

#### THE GUILLEMOTS (*Uria*, Brisson & Illiger),—

With the general form of the beak of the preceding, have it covered with feathers as far as the nostril, and emarginated at the tip, which is a little arcuated. Their principal distinction, however, consists in wanting the back-toe. Their wings, much shorter than those of the Loons, barely suffice for the function of flying. They feed on fish and crustaceans, and are found about the precipitous rocks on which they breed.

[These birds, the first of which is merely an Auk with a more slender bill, fly with considerable swiftness in a straight line, their wings being reduced to the minimum extent adequate for aerial support, in order that they might be more efficient under water, where no use whatever is made of the feet, which are held out like those of a wading bird when cleaving the air. Accordingly they literally fly under water, whereas the subaquatic progression of a Grebe more resembles that of a Frog, and the Loons do not generally use the wings at all: hence the prolongation forward of the fixed patella, so considerable in the Loons, which is reduced in the Grebes, and entirely wanting in the Auks, Puffins, and Guillemots, which form a particular group, found only in the ocean. The latter have also smaller cæca, a particularly tough cuticular lining to the stomach, of a bright yellow colour, a different sternal apparatus, which most nearly approximates that of the Loons, diverse plumage and seasonal changes, &c. They are pre-eminently remarkable for the manner in which the skeleton incloses the viscera as in a box, in order to resist the pressure of deep water; while their air-cavities are unusually large, which causes them to float very high when on the surface, and are obviously designed to increase the standard of respiration so as to permit of their sustaining themselves in the air with their short and narrow wings, these, however, not being violently beaten in the act of flying. Their movements under water precisely resemble those of the *Dytiscide*, or common Water Beetles; the principal motion being more or less vertical, instead of horizontal as in the Grebes and Loons: they are, therefore, together with the distinct group of Penguins, the most characteristic *divers* of the class.

One common on the precipitous coasts of all Britain, is the Common Guillemot (*U. troile*), of a dusky slate-colour above, white beneath, and a bar of the same on the wing, formed by the tips of the secondaries; the throat black in summer, white in winter. It lays only one egg, of enormous proportional magnitude, and remarkably variable in colour. The young at first resemble the adults in summer dress; but their first plumage, which succeeds the down, and the texture of which is singularly delicate, presents the colouring of the adult winter-garb, and is exchanged for the latter in the course of a few weeks. They breed in vast numbers on the narrow ledges of rocks, where in many places they are seen sitting in successive rows, one over another. In autumn they migrate southward, those which breed on the British shores being replaced by others from more northern latitudes.

Another and smaller species, is the Black Guillemot (*U. grylle*), entirely black, with a great white wing-spot, in



Fig. 125.—Sternum of Guillemot.



summer, and everywhere mottled with white in winter: the bill and feet red. Its range is more northerly, rarely if ever breeding to the southward of the Scottish Isles, and producing two and often three eggs, proportionally smaller, and singularly different from those of the other, both in shape and colour. It is less allied to the Common Guillemot than the latter is to the Auks, with which an intermediate species, rarely found on the British coasts, tends even to connect it,—the *U. Brunnicus*, which scarcely differs except in the more robust form of the bill. There is also a breed of the Common Guillemot found on the Welsh coast, and some other places, which has a narrow white line from the bill to the eye, as in the Razor-billed Auk.]

THE ROTCHER (*Cephus*, Cuv. [*Mergulus*, Ray and Vieillot]),—

Has a shorter bill, more arcuated above, and unemarginated; the symphysis of the lower mandible extremely short. Its wings are stronger, and the membranes of the feet somewhat notched.

The known species, termed *Little Auk* and *Greenland Dove*, (*C. alle*; *Colymbus minor*, Gmelin), is not larger than a Pigeon, and black above, white below, with the same mark on the wing as the Common Guillemot. It inhabits the arctic shores, where it breeds on the ground, and is occasionally met with in our latitudes during the winter.

The genus of

THE AUKS (*Alca*, Lin.)—

Is known by its extremely compressed beak, raised vertically, sharp along the ridge, and ordinarily grooved on the sides, together with its feet entirely palmated and without back toe, the same as in the Guillemots. The species are all from the northern seas.

They require to be divided into three subgenera.

THE PUFFINS (*Fratercula*, Brisson; *Mormon*, Illiger),—

Of which the beak, shorter than the head, is as high or higher than it is long, giving it a very extraordinary form, while its base is generally furnished with a folded skin. The nostrils, placed near its edge, are mere slits. Their short wings can just sustain them for a brief period, and they reside in the ocean like the Guillemots, and nestle in the rocks, [or rather they burrow holes in loose soil, and lay their single egg at the depth of several feet. They run or creep swiftly on the ground, and the Auks and Guillemots can also waddle with more speed than might be anticipated from the shortness of their legs].

The common species (*Alca arctica*, Lin.; *Mormon fratercula*, Tem.), is a little larger than a Pigeon, with black mantle, calotte, and collar, and the rest white. [Legs orange; bill brightly coloured; and a slip of loose skin at each eye. It is common in suitable localities on the British shores, flies rapidly, and may often be seen to return to its mate or young, with a number of small fishes curiously ranged on each side of its bill, each held by the head. The young are at first covered with long and flocculent black down, which is replaced by delicately soft plumage analogous to that of the young Guillemot, succeeded by the adult garb in the course of a few weeks, which last undergoes no seasonal changes].

M. Temminck distinguishes as

THE PHALERINS (*Phaleris*, Tem.),

Those species which have the beak less elevated; as,

The *Alca cristatella*, Vieillot, and *A. peittacula*, Pallas. [Six species are known on the arctic shores of America, one forming the *Ceratomyrchus*, Bonap.; some of these extend to the north of Siberia.]

THE RESTRICTED AUKS (*Alca*, Cuv.)—

Have a more lengthened beak, resembling the blade of a knife; feathers at its base as far as the nostrils, [the same as in the Guillemots, to which they are most nearly allied,] and wings decidedly too small to support them, inasmuch as they cannot fly at all; [an erroneous statement respecting one of the two species].

The Razor-bill Auk (*Alca torda* and *pica*, Gmelin). [Plumage and seasonal changes of the Common Guillemot, only that the black is more deep, and some white transverse lines on the bill. It is rather smaller than that species, which it exactly resembles in habit and extent of wing, flying equally well: inhabits the same cliffs, but less numerously; and commonly lays two eggs, sometimes three, of similar character to those of the Black Guillemot: has a croaking voice.]

The Great Auk (*A. impennis*, Lin.).—Colours of the preceding, but the beak marked with eight or ten cross grooves, and an oval white spot between the eye and bill. It lays but one great egg, spotted with purplish. [This species, which is larger than a Goose, is the only northern sea-fowl utterly deprived of the function of flight, and has accordingly its wings reduced to exactly that size which is most efficient of all for subaquatic progression: they are not larger than very moderate-sized fins, and the limb-bones are considerably weightier and less solid than those of its congener; but we are not aware that the skeleton makes any approach in form to that of the

Penguins of the southern hemisphere, which are very distinct from the Auks. As a particularly rare visitant, this species is allowed a place in the British Fauna.]

The genus of

THE PENGUINS (*Apfenodytes*, Forster)—

Is even less capable of flying than that of the Auks. Their little wings, covered with mere vestiges of feathers, which at the first glance resemble scales; their feet, placed farther back than in any other bird [the Grebes and Loons alone excepted,] only support them by bearing on the tarsus, which is widened like the sole of the foot of a quadruped, and in which are found three bones soldered together at their extremities. They have a small hind toe, directed inwards, and their three anterior toes are joined by an entire membrane. These birds are found only in the antarctic seas, never going on shore except to breed. They can only reach their nests by trailing on their bellies. The difference in the bill authorizes their division into three subgenera.

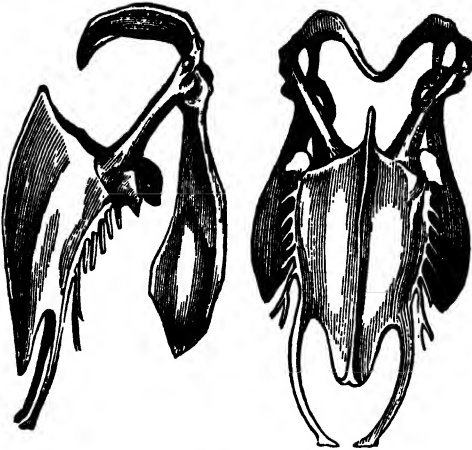


Fig. 126.—Sternum of Penguin.

in this the nostril is placed, from which a groove extends to the tip.

The Patagonian Penguin (*Apt. patagonica*, Gm.).—Size of a Goose, and slate-coloured above, white underneath, with a black mark, encircled by a citron-yellow cravat. It inhabits the vicinity of the Straits of Magellan in large flocks, ranging as far as New Guinea. Its flesh, although black, is eaten.

THE GORFEWS (*Catarrhactes*, Brisson)—

Have a stout and pointed beak, somewhat compressed, with a rounded ridge, and tip a little arcuated; the groove which extends forward from the nostril terminates obliquely on the inferior third of its edge.

The Crested Gorfew (*Apt. chrysocoma*, Gm.).—Size of a large Duck, black above, white below, and adorned with a white or yellow crest on each side of the occiput. It is found in the vicinity of the Falkland Isles and of New Holland, and sometimes leaps out of the water while swimming. Deposits its eggs in a hole of the ground. There are several others.

THE SPHENISCANS (*Spheniscus*, Brisson)—

Have a straight and compressed beak, irregularly furrowed at the base; the tip of the upper mandible hooked, and of the other truncate; nostrils situate in the middle, and uncovered.

The Cape Spheniscan (*Apt. demersa*, Gmelin).—Black above, white below, the beak brown, with a white band in the middle, throat black, and a line of the same upon the breast, which is continued along each flank. It chiefly inhabits the neighbourhood of the Cape, where it nestles among the rocks. [Fig. 126 represents the sternal apparatus of this species, showing the peculiar configuration common to the group, and particularly the broad scapula. The bones of the Penguins are permanently filled with marrow.]

The family of

LONGIPENNES

Comprehends those Birds of the high seas, which, in consequence of their capability of protracted flight, are met with everywhere, [though it does not appear that the particular species are more widely diffused than others]. They are known by the freedom or total absence of the thumb, their very long wings, and smooth-edged beak, which in the greater number of genera is hooked at the tip, and in the others simply pointed. Their inferior larynx has only one muscle proper on each side, and the gizzard is muscular [or lax and very capacious], the cocca short [or moderate].

THE PETRELS (*Procellaria*, Lin.).—

Have the beak hooked at the tip, with its extremity appearing as though a piece had been articulated to

the rest; their nostrils are united to form a tube, which lies along the back of the upper mandible; and their feet, instead of a back toe, have merely a claw implanted in the heel. They are, of all the *Palmipedes*, those which remain most constantly at a great distance from land; and when a tempest comes on, they are often compelled to seek refuge on reefs and ships, from which circumstance they derive their name of *Storm-birds*: that of *Petrel* (a diminutive of *Peter*.) has been applied to them from their habit of walking on the waves, which they do with the assistance of their wings. They nestle in the holes of rocks, [producing but a single egg,] and spurt upon those who disturb them an oily fluid, with which their stomachs appear to be always filled. The greater number of species inhabit the Antarctic seas. [Their stomach is extremely capacious, and but slightly muscular, and they feed principally on oily substances.]

Those are more particularly called Petrels (*Procellaria*), the lower mandible of which is truncated.

The largest species, or Giant Petrel (*Proc. gigantea*), inhabits the Austral Seas, and exceeds a Goose in size. Its plumage is blackish, but with varieties more or less white. In the same seas is found

The Spotted Petrel (*Pr. capensis*).—Size of a small Duck, and white, spotted with black above. It is often mentioned by navigators [as the *Cape Pigeon*].

The Fulmar Petrel (*Pr. glacialis*).—White, with ash-coloured mantle, the bill and feet yellow, and size that of a large Duck. It nestles in the precipitous coasts of the [northern] British isles, and is found throughout the whole north. [It has been computed that this species is the most numerous in individuals of the whole class. Though rare in our latitudes, its numbers in the Arctic seas are inconceivable.]

#### THE STORM-PETRELS (*Thalassidroma*, Vig.)—

Are certain small species, with a somewhat shorter bill, rather longer legs, and black plumage, which are more particularly designated *Storm-birds* [and *Mother Carey's Chickens*] by mariners. [Their habits are crepuscular and nocturnal, as are also those of most of the tribe; and their flight considerably resembles that of a Swallow.]

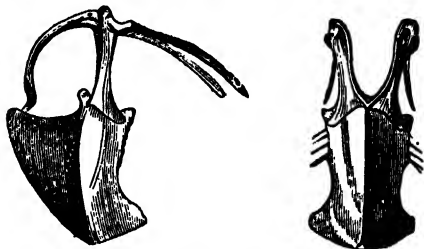


Fig 127.—Sternum of Storm Petrel.

The most common (*Proc. pelagica*, Brisson) is scarcely larger than a Lark, but stands higher on the legs. It is entirely brown-black, except the croup, which is white, and there is a trace of white on the greater wing coverts. When this bird seeks a shelter upon vessels, it is a sign of an approaching storm. [That of America (*Ph. Wilsonii*) is distinct, and is sometimes met with on our shores; as is

also a third species with a forked tail, *Th. Bullockii*. After tempestuous weather, these birds are not unfrequently found far inland, generally upon the high road, unable to rise].

We separate, with Brisson, by the name of

#### THE SHEARWATERS (*Puffinus*).—

Those species in which the tip of the lower mandible is curved downwards, like that of the upper, and the nostrils of which, although tubular, do not open by a common orifice, but by two distinct holes. Their beak also is proportionally longer.

The Cinereous Shearwater (*P. cinereus*; *Proc. puffinus*, Gm.).—Ash-coloured above, whitish beneath, with the wings and tail blackish; the young rather more deeply coloured. Its size is nearly that of a Crow, and it is found almost everywhere, [but rarely so far north as on the British shores].

A smaller species was long confounded with it, black above and white below, the Manks Shearwater (*P. anglorum*), which inhabits the northern shores of Scotland and its isles in immense numbers, and which the inhabitants salt for winter provision. [A third (*P. obscurus*, Vieillot) has occurred in Britain, and there are two or three more, further south.]

Navigators sometimes mention, under the name of Petrels, certain birds of the Antarctic seas, which should make two particular genera. One is

#### THE HALADROME (*Haladroma*, Illiger).—

Which, with the beak and form of the Petrels and Shearwaters, has a dilatable throat like the Cormorants, and entirely wants the thumb, as in the Albatrosses.

Such is *Pr. urinator*, Gmelin.

The other is

THE PRIONS (*Pachyptila*, Illiger).—

In other respects similar to the Petrels, have separate nostrils like the Shearwaters, and the beak widened at its base, its edges being interiorly furnished with fine, pointed, vertical laminae, analogous to those of the Ducks.

These are the *Blue Petrels* (*Proc. vittata* and *caerulea*, Forster).

THE ALBATROSSES (*Diomedea*, Lin.).—

Are the most massive of all aquatic birds. Their large, stout, and trenchant beak, with strongly marked sutures, is terminated by a hook, which looks as if articulated. The nostrils resemble short rolls, laid on each side of the beak; and the feet have no hind toe, not even the little nail which is found in the Petrels. They inhabit the Austral seas, and feed on the spawn of Fishes, Mollusks, &c.; [indeed, upon whatever falls in their way. They pertain to the same particular group as the Petrels, which they resemble in their whole anatomy. Their webbed feet are equally large, and they have the same habit of trampling on the waves].

The species best known to navigators, or the Giant Albatross (*D. exulans*, Lin.), has been termed the *Cape Sheep* from its size, having white plumage, and black wings. The English also style it the *Man-of-War Bird*, [a mistake, as this term applies to the Tachypete]. It is particularly common beyond the tropic of Capricorn, and is the great enemy of the Flying Fish. This bird constructs a high nest of earth, and lays numerous eggs [each individual, however, one only, and generally in company with Penguins], which are esteemed good eating: its cry is very loud. There are three or four others, about two-thirds the size.

THE GULLS (*Larus*, Lin.).—

Have the bill moderately long, compressed, and pointed, the upper mandible arcuated towards the tip, and the lower forming a projecting angle beneath. Their nostrils, placed near its middle, are long, narrow, and pierced quite through, [the beak having little bony substance in comparison with those of the Petrels and Albatrosses]. Their tail is full, the legs tolerably elevated, and the thumb short. They are cowardly and voracious birds, which abound along the sea-shore, and feed on all sorts of fish, carrion, &c. They nestle in the sand or in clefts of rocks, and lay few eggs, [generally three in number]. When they come inland, bad weather may be expected. Several species of them are found on our coasts; and as their plumage varies exceedingly with age, they have been further multiplied by systematists. In general, during youth, they are mottled with greyish. [These birds have a capacious gullet, and small gizzard, which becomes more muscular with age. Their general anatomy is considerably allied to that of the *Calcatores*, or Snipes and Plovers. Their toes are shorter than in the preceding genera, and the feet better fitted for walking on land.

Those of Britain are—the Great Black-backed Gull (*L. marinus*), white, with a black saddle; bill four inches long, and with the orbits yellow; of common occurrence: the Glaucous Gull (*L. glaucus*), with a very pale silvery saddle, and entirely white quills, from which we do not regard the Iceland Gull (*L. islandicus*, Auct.), of Europe, as distinct, having obtained intermediate specimens of every grade of size; it is rare on the coasts of South Britain: the Herring Gull (*L. argentatus*), the commonest of all, differing from the first chiefly in its inferior size and ash-coloured mantle: the Lesser Blackbacked Gull (*L. fuscus*), somewhat less than the Herring Gull, and similar to the first, but not so deeply coloured, and having yellow legs instead of flesh-coloured, and red orbits; which is rather common: the Mew Gull (*L. canus*), a diminutive of the Herring Gull, with white legs: the Kittiwake Gull (*L. risso*), rather smaller still, and at once distinguished by the total absence of hind-toe; both of these being common in particular localities: and the Ivory Gull (*L. eburneus*), the adult plumage of which is wholly pure white, contrasting with black feet, and which is only an occasional straggler in the British seas. All these are, for the most part, rock-builders.

Others, the *Xema* of Leach, have a black hood in summer, like the Terns, and are generally slighter-made, breeding chiefly in marshes. The commonest in Britain is known as the Hooded Gull (*L. ridibundus*), with the head and upper neck brownish-black during the breeding season, and bill and legs bright vermillion: the Masked Gull (*L. capistratus*) is rather smaller, with the hood considerably reduced, and is not common: *L. atricilla* is larger than either, with a stouter bill, and black legs; also very rare: *L. sabini*, smaller than the Masked Gull, is at once distinguished by its forked tail, and is met with occasionally in Ireland and the west of Britain: and *L. minutus*, the smallest of all, not exceeding ten inches in length, and equally uncommon upon the British shores, is known by its size. There are many more, of both divisions.]



Fig. 128.—Sternum of Gull.

From the Gulls have been very properly separated

THE SKUAS (*Lestris*, Illiger).—

The membranous nostrils of which, larger than in the preceding, open nearer to the point and edge of the beak; the tail also is pointed, [and they have great cæca]. They eagerly pursue the smaller Gulls to rob them of their food, and, as has been said, to devour their excrement; [the truth being, that they cause them to disgorge, whereupon they seize the food before it reaches the water, being endowed with uncommon power of flight]: hence their name, [*Lestris*, or robber.

Four species occur on the British shores, successively smaller, with the middle tail-feathers prolonged in the same ratio. The largest (*L. cataractæ*), nearly the size of the Great Black-backed Gull, has deep brown plumage, with the middle tail-feathers but slightly elongated. It breeds on certain of the northern Scottish isles, high upon the mountains, defending its nest with extraordinary spirit and intrepidity, and furiously driving off Eagles from the vicinity, for which reason it is protected by the inhabitants, as a guard to their flocks. The Pomarine Skua (*L. pomarinus*) is smaller, and though generally exceedingly rare, makes its appearance in certain seasons in considerable numbers, as in the instance of November, 1837. *L. Richardsonii* is the next in size, which is common about the northern Scottish isles; and *L. parasiticus*, the smallest, which belongs more properly to America, has exceedingly long middle tail-feathers. The females of these birds are larger than the males, which is the reverse of what is observable in the Gulls; and they lay but two eggs, of a dark colour].

THE TERNS (*Sterna*, Linn.)—

Are termed *Sea-swallows*, from their extremely long and pointed wings, their forked tail, and short legs, which induce a port and flight analogous to those of the Swallows, [the true Terns, however, *winnowing* more in the manner of the Gulls]. Their beak is straight, pointed, and compressed, without curvature or projection; having the nostrils near its base, oblong, and pierced quite through. The membranes which connect their toes are deeply emarginated, and they swim little, [if at all]. They fly in every direction and with great rapidity, uttering loud cries, and skilfully raising from the surface of the water mollusks and small fishes, upon which they feed, [and to obtain which they often plunge]. They also penetrate to the lakes and rivers of the interior. [Their anatomy precisely accords with that of the Gulls, as do also the character of their plumage, their seasonal and progressive changes, mode of propagation, eggs, &c.

The British species fall into two principal groups; the majority having the same black calotte in spring as the *Xema* Gulls. The commonest (*St. hirundo*) has an ashy mantle, red feet, and the bill red with a black tip. The Arctic Tern (*St. arctica*), common along our northern coasts, is rather smaller, with shorter legs, and underparts tinged with ash-colour. The Little Tern (*St. minuta*) is distinguished by its very inferior size, and white forehead. The Sandwich T. (*St. cantiaxa* and *Boysii*) is larger than any of the foregoing, with black feet, and often a tint of roseate on the breast. In the Roseate T. (*St. Dougalli*), the same tinge is brighter, and the feet are orange. The Gull-billed T. (*St. anglica*) has the bill prominent at the symphysis, as in the Gulls; but notwithstanding its received systematic name, is extremely rare in Britain. The Caspian T. (*St. caspia*), occasionally met with in the Channel, is very considerably larger than any of the others. The two last are principally marsh Terns; and the most characteristic of these is the Black Tern (*St. nigra*), with tail less deeply forked than in the others, membranes of the feet more reduced, and smaller bill, which subsists chiefly on insects taken on the wing, and flies more like a Swallow. There are numerous others.]

We might distinguish from the other Terns,

THE NODDIES (*Megaloptyrus*, Boié).—

The tail of which is not forked, [but the reverse,] and even with the wings; and the bill has a slight salient angle, the first indication of that in the Gulls; [whilst the character of the plumage resembles that of a Petrel, and the feathers are not continued forward to the nostrils]. We only know of one,—

The Black Noddy (*Sterna stollida*, Lin.).—Brown black, the front of the head whitish. It is well known to seamen for the stupidity with which it throws itself on vessels [and allows itself to be taken. Is one of the most widely distributed of birds; and has occurred on the Irish coast. M. Audubon found its nests in vast numbers, placed upon bushes, in an island uninhabited by Man].

THE SKIMMERS (*Rhyncops*, Linn.)—

Resemble the Terns by their short feet, long wings, and forked tail; but are distinguished from all other birds by their extraordinary bill, the upper mandible of which is shorter than the other, both being flattened into simple [vertical] laminae, which meet without clasping. Their only mode of feeding is by skimming their aliment from the surface of the water with the lower mandible as they fly.

The first known species (*R. nigra*, Lin.), is white, with a black calotte and mantle, a white streak over the eye, and the external tail-feathers white outside, bill and feet red. From the vicinity of the Antilles. There are four or five others.

The third family, or that of the

#### TOTIPALMATI,

Is characterized by the thumb being united with the other toes by one single membrane; though, notwithstanding this conformation, which renders their feet perfect oars, they are almost the only *Palmipedes* which perch on trees. All of them fly well, and have short legs. Linnæus arranged them in three genera, the first of which requires to be subdivided.

#### THE PELICANS (*Pelicanus*, Lin.)—

Comprehend all those wherein some naked space is found at the base of the bill. Their nostrils are mere fissures, the aperture of which is scarcely [or not at all] perceptible. The skin of the throat is more or less extensible, and the tongue extremely small. Their attenuated gizzard forms, with their other stomachs, a great sac, [which in several is furnished with an accessory pouch, analogous to that of the Crocodiles], and they have only middling or small cæca. [Their nostrils, which are always pervious in the nestling, soon become entirely closed in the greater number of genera. The furcula is always

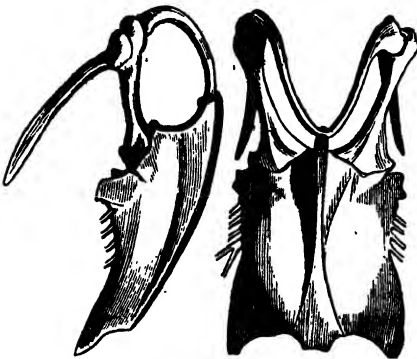


Fig. 129.—Sternum of Cormorant.

anchylosed to the anterior portion of the sternal ridge. Their eggs are encased with a soft, absorbent, chalky substance, over the hard shell; and the young are at first covered with long and flocculent blackish down, remaining very long in the nest, and generally much exceeding the parents in weight when they leave it. None of them appear to moult before the second autumn. The greater number have bright green irides.]

#### THE PELICANS, properly so called (*Pelicanus*, Illiger; *Onocrotalus*, Brisson),—

Have the beak very remarkable for its inordinate length, its straight, very broad, and horizontally-flat-

tened form, for the hook which terminates it, and finally for the lower mandible, the flexile rim of which supports a naked membrane, which is dilatible into a voluminous pouch. Two grooves extend throughout its length, in which the nostrils are concealed. The circumference of the eyes is naked, like the throat. The tail round.

The common European Pelican (*Pel. onocrotalus*, Lin.).—As large as a Swan, and wholly white, slightly tinged with carneau, [and having the breast deep buff-colour in old specimens]. The hook of the bill cherry-red. It is more or less plentifully diffused over the eastern world, nidificates in the marshes, and subsists entirely on live sh. Is reported to convey provisions and water in its pouch. Two or three others have been distinguished.

#### THE CORMORANTS (*Phalacrocorax*, Briss.; *Carbo*, Mey.; *Halieus*, Ill.)—

Have the beak elongated, with the tip of the upper mandible hooked, and that of the other truncate. The tongue very small; and the skin of the throat less dilatible. The nostrils are like a little one, which does not seem to be pervious. The middle claw has a serrated inner edge. [Tail stiff and ineated. It may be added, that the feet are placed backwards, in adaptation to diving habits, but are ill tolerably free, these birds employing both the wings and feet in subaquatic progression. Their racity is proverbial: and their intelligence surpasses that of most other birds, as does likewise their facility: hence they were formerly trained in Europe for fishing, as Hawks are for fowling, and they are still so employed in the East. The species are exceedingly numerous, and some are found almost everywhere.

Two are very common on the British coasts.

The Bronzed Cormorant (*Pel. carbo*, Lin.).—Size of a Goose, and bronzed black, with fourteen tail-feathers. Both sexes develop, towards the breeding season, various accessory ornamental feathers about the head and neck, at which time the naked skin becomes brightly coloured, and a tuft of white feathers grows upon each

flank. These ornaments fall in a few weeks, and are but imperfectly developed in younger individuals, and seldom except in a state of perfect liberty. In some parts of Europe, this species builds upon house-tops, and not unfrequently on trees: but on the British coast, they mostly resort to precipitous rocks or islets, generally in society. From their croaking voice, dark colour, and appearance on the wing, they are often termed *Sea Crows*. They can climb with considerable facility, aided by the beak and rigid tail-feathers. Occasionally they fly to inland waters and fish-preserves, where they are notoriously destructive, and are observed to evince a marked preference for Eels.

The other species, or Crested Cormorant, (*Phal. cristatus*, Oless), is smaller, and less robust, with only twelve tail-feathers; its glosses incline more to green, and the adults have an elegant recurved crest during the breeding season. This bird is commoner towards the north, while the preceding is more numerous southward: nevertheless, the Bronzed Cormorant appears to occur in both continents, whereas the Crested is represented in North America by a different one (*Ph. dilophus*), both of these extending to high latitudes, though respectively peculiar to the Old and New World, so far as has yet been observed.

A third European species is the Black Cormorant (*Pel. graculus*, Gm.); a diminutive of the first, but possessing only twelve tail-feathers, like the preceding, with which it has been confounded until very recently, by British naturalists. It inhabits to the southward of the British Isles, in which it has not hitherto been met with.]

#### THE TACHYPETES (*Tachypetes*, Vieillot)—

Differ from the Cormorants by a forked tail, short feet, the membranes of which are very deeply notched, an excessive spread of wing, and a beak both mandibles of which are curved at the tip. Their wings are so powerful that they fly at an immense distance from all land, and principally between the tropics, darting upon the Flying-fish, and striking the Gannets to make them disgorge their prey.

One only is known (*Pel. aquilus*, Lin.), the plumage of which is [richly empurpled] black, the under-part of the throat more or less varied with white, and the beak red. Its extent of wing is reported to be sometimes ten or even twelve feet. [This is the noted *Frigate-bird*, or *Man-of-War-bird*, of the English sailors, which is surpassed in command of wing by none of the class, if equalled by any. It breeds on trees on uninhabited islands, and lays a single spherical white egg.]

#### THE GANNETS (*Sula*, Brisson; *Dysporus*, Illiger)—

Have a straight beak, slightly compressed and pointed, with the tip a little arcuated, and its edges serrated, the denticulations [which are more developed in the Cormorants] directed backwards: the [impervious] nostrils are prolonged in a line nearly to the tip: the throat is naked, as is also the skin of the eyes; the former but slightly extensible: inner edge of the middle claw serrated. The wings are less extended than in the Tachypetes, and the tail is a little cuneated. These birds are called *Boobies*, on account of the stupidity with which they [certain species of them] allow themselves to be attacked by men and birds, more particularly the Tachypetes, which, as already stated, force them to yield up the prey they have captured.

The most common is the European Gannet (*Pel. bassanus*, Lin.).—White, with black feet and wing primaries, the bill greenish, and nearly equal in size to a Goose. [A common species in the British seas, which breeds in vast numbers upon the Bass rock in the Frith of Forth, and one or two other similar localities: the young are at first covered with the blackish down common to the group, in which they contrast remarkably with their white parents; their first plumage is dark above, beautifully speckled with white, these terminal specks gradually wearing off. The Gannets take their prey by plunging upon it from on high, and sail with an easy flight, with little motion of the wings. Their air cavities are extraordinarily developed; the ambient medium permeating all their bones with the exception of the phalanges of the toes, and passing under the skin of the breast, which is only attached to the muscles by a number of scattered connecting pillars; a structure which is also met with in the Phaetons.]

#### THE ANHINGAS (*Plotus*, Lin.)—

With the body and feet nearly like those of a Cormorant, have a very long neck, and a slender, straight, and pointed bill, with denticulated edges; the eyes and nudity of the face as in the Pelicans, of which they have likewise the habits, nestling, like those birds, upon trees. [They may be described as Cormorants, with the bill and neck of a Heron.

Two or three species are found, in both continents; the body inferior in size to that of a common Duck.]

#### THE PHAETONS (*Phaeton*, Lin.)—

Are known by their two very long and slender tail-feathers, which, at a distance, resemble a straw. Their head has no naked part. The beak is straight, pointed, denticulated, and moderately stout, [with pervious nostrils at all ages]: their feet are short, and their wings long. Accordingly, they fly very far from land, on the high seas; and as they rarely quit the boundaries of the torrid zone, their appearance serves to indicate to mariners the vicinity of the tropic, [whence their common name of

Tropic-birds]. On land, where they seldom resort except to breed, they perch upon trees. [They are closely related by affinity to the Gannets.]

Several species are known, with white plumage, more or less varied with black, [and tinged in some with roseate,] which do not exceed the size of a Pigeon.

### The family of

#### LAMELLIROSTRES

Is distinguished by a thick bill, invested with a soft skin rather than with true horn, [the fact being, that the corneous portion is restricted to the nail-like extremity, the rest corresponding to what is known as the *cere*]: its edges supplied either with laminae, or small teeth, [which are modifications of each other]: the tongue large and fleshy, with a dented border. Their wings are of moderate length. They live more in fresh waters than in the sea: and, in the greater number, the trachea of the male is dilated near its bifurcation into capsules of various form. Their gizzard is large, very muscular, and the *cæca* [generally] long. [These birds lay numerous spotless eggs, and the young follow their parent as soon as hatched.]

The great genus of

#### THE DUCKS (*Anas*, Lin.)—

Comprehends those *Palmipedes* which have a large and broad bill, the edges of which are beset with salient laminae placed transversely, and the purport of which appears to be for straining off the water when the bird has seized its prey. They divide into three subgenera, the limits of which, however, are not very precise.

#### THE SWANS (*Cygnus*, Meyer)—

Have the bill of equal breadth throughout, and higher than wide at the base; the nostrils placed about midway: and the neck exceedingly elongated, [possessing twenty-three vertebrae\*]. They are the largest birds of this genus, and feed chiefly on the seeds and roots of aquatic plants, [together with the grass which grows near the brink of water]. Their intestines, and *cæca* more especially, are accordingly very long. Their trachea has no inflation or labyrinth.

[Swans are essentially modified Geese, and like the latter are exclusively vegetable feeders, with similar plumage in both sexes, which is moulted once only in the year, and undergoes no seasonal variation of colour. They attack with the same hissing note, strike similarly with their wings, and the male guards the female during incubation, and accompanies her while followed by her brood. They fall into two subdivisions.

In the first, the trachea, after describing a slight curve towards the sternal ridge, proceeds to the lungs without entering any cavity in the bone. When swimming, they often erect the tertial plumes of the wing, in an elegant manner. Three of the four species have a fleshy caruncle over the base of the upper mandible, beneath which the bone is protuberant.

The Mute Swan (*Anas olor*, Gmelin), or common domesticated species, the adults of which are wholly pure white, with a reddish bill, surmounted by a black protuberance, and leaden-black feet: young, grey, with the bill lead-coloured. The wild breed (*C. immutabilis*, Yarrell) is rather smaller, with the rostral protuberance less developed in the few specimens examined: there is also a semi-albino domestic race, with feet whitish, or partially so, and reported to have white cygnets, which is termed the *Polish Swan* by the dealers; it varies in size, some attaining the largest dimensions of the ordinary tame breed. We are satisfied, from anatomical examination, that these are all specifically the same. The wild race is rarely met with in Britain. These birds do not appear to breed before the third year.

The Black Swan (*A. atrata*, Latham; *A. plutonia*, Shaw).—Less than the preceding, and not so elegant in its conformation, with its tertials curled upwards: colour black, with the exception of its white primaries, and the bill and naked skin at its base, which are red. It is common in New Holland, and propagates readily twice a year, or oftener, when brought to Europe.

The Black-necked Swan (*C. nigricollis*).—White, with black neck and tips of the primaries; the sides of the head white, and bill and feet orange, the former having a black protuberance. Common in South America.

The smallest of all, or Duck-billed Swan (*C. anatoides*, King.), is also from South America, inhabiting towards the Straits of Magellan. Colour pure white, with black tips to the primaries, and bill and feet orange: the former having no basal protuberance. With the exception, therefore, of the common mute species, this division pertains to the southern hemisphere.

The rest have the trachea elongated as in the Cranes, and similarly entering a cavity in the sternal

\* We have found this number in four species, viz., *C. olor*, *atrata*, *muscus*, and *Bewickii*.—Ed.



flank. These ornaments fall in a few weeks, and are but imperfectly developed in younger individuals, and seldom except in a state of perfect liberty. In some parts of Europe, this species builds upon house-tops, and not unfrequently on trees: but on the British coast, they mostly resort to precipitous rocks or islets, generally in society. From their croaking voice, dark colour, and appearance on the wing, they are often termed *Sea Crows*. They can climb with considerable facility, aided by the beak and rigid tail-feathers. Occasionally they fly to inland waters and fish-preserves, where they are notoriously destructive, and are observed to evince a marked preference for Eels.

The other species, or Crested Cormorant, (*Phal. cristatus*, Oless), is smaller, and less robust, with only twelve tail-feathers; its glosses incline more to green, and the adults have an elegant recurved crest during the breeding season. This bird is commoner towards the north, while the preceding is more numerous southward: nevertheless, the Bronzed Cormorant appears to occur in both continents, whereas the Crested is represented in North America by a different one (*Ph. dilophus*), both of these extending to high latitudes, though respectively peculiar to the Old and New World, so far as has yet been observed.

A third European species is the Black Cormorant (*Pel. graculus*, Gm.); a diminutive of the first, but possessing only twelve tail-feathers, like the preceding, with which it has been confounded until very recently, by British naturalists. It inhabits to the southward of the British Isles, in which it has not hitherto been met with.]

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ridge. They carry the neck more upright, and never elevate the tertial plumes. None of them has any protuberance on the base of the bill; and they have all white plumage with black feet, or, in the young, grey plumage with white wings, and the feet white when newly hatched. They yield the swan's down of commerce, which is much inferior both in quality and quantity in the others; and are restricted in their distribution to the northern hemisphere.



Fig. 130.—Sternum of Bewick's Swan.

Of four species, two are respectively peculiar to each continent.

The Trumpeter Swan (*C. buccinator*) of America is the largest, and yields most of the down of commerce, together with the next species. Its bill is wholly black, and the trachea forms a double vertical convolution within the sternal ridge, and is bifurcated into short inflated bronchi.

Audubon's Swan (*C. Auduboni* and *americana*) is smaller, but fully equals the European Hooper Swan in size, although it has been confounded with *C. Bewickii*. Its bill has an orange-yellow spot on each side towards the base, and the trachea forms a horizontal flexure within the inflated hind-margin of the sternum, having similar bronchi to those of the last.

Bewick's Swan (*C. Bewickii*) is considerably smaller, with exactly similar tracheal apparatus, and a larger orange-yellow space at the base of the bill, extending to the nostrils. Of seventeen specimens dissected by us, one only presented the horizontal flexure of the trachea (represented from the identical specimen in fig. 130), though several were evidently older birds: but the inflated form of the bronchi constitutes an invariable distinction from the next species.

Tail-feathers generally twenty, sometimes eighteen, and we have more than once met with nineteen, where none had been lost. It is much less common in Britain, as a winter visitant, than the next.

The Hooper Swan (*C. musicus*, *Anas cygnus*, Lin.), or common Wild Swan of Europe, which visits Britain in abundance in severe winters. The largest specimens are scarcely inferior in size to the Mute species, and have the most extended brilliant-yellow space at the base of the bill of any, extending beyond the nostrils. The trachea forms but a single vertical flexure, and the bronchi are much longer than in the others, and not inflated. On dissecting a cygnet in its down, we found the cavity of the sternal ridge completely formed, but the trachea did not enter. The tail-feathers are generally twenty, and sometimes twenty-one or twenty-two. All these birds utter loud trumpeting cries, and the present species has also a low musical note, which is often repeated.]

We can scarcely distinguish from the Swans certain species, which undoubtedly are less elegant, but have the same beak. As

The Knobbed Goose (*Anas cygnoides*, Lin.), which we rear in our poultry-yards, and which interbreeds readily with the common domestic species. The base of its upper mandible is protuberant, as in the Mute Swan, and its neck is whitish, with a dark streak passing down the back of it. [In every essential particular, this is a true Goose, and has sixteen cervical vertebrae, like the rest of that genus. Its flesh is less highly esteemed than that of the common bird; than which, however, it is considerably more prolific, propagating at all seasons. As in the other Geese, it seeks its food principally, or it may be said wholly, on land, and utters loud noisy cries.]

The Spur-winged Goose (*Anas Gambensis*, Lin.).—Remarkable for its size, its elevated legs, the tubercle upon its forehead, and the two stout spurs with which the bend of its wing is armed. Its plumage is empurpled black, [very like that of a Musk Duck, to which this species is considerably allied, notwithstanding its long legs. It forms the genus *Plectropterus* of Swainson.

The author also includes among the Swans the Canada Goose (*A. canadensis*), which also possesses every intrinsic character of the true Geese. It is a very large species, with a long black neck, and white mark across the throat, as in the Black-necked Swan; which is likewise readily domesticated, and breeds plentifully in Europe. Another nearly allied (*A. Hutchinsonii*) has more recently been discovered in the same country—North America, from which neither has been known to stray across the Atlantic in the wild state, though found very far to the north. The first down of all the Geese is mottled, of the Swans plain.]

#### THE GEESSE (*Anser*, Brisson).—

Have the bill moderate or short, narrower in front than behind, and higher than broad at the base; the legs longer than in the Ducks, and placed nearer the middle of the body, to facilitate their gait on land. They have no labyrinth at the bottom of the trachea, nor does the latter form any curve in the known species. Several [all] feed on grass and grain.

#### THE GEESSE, properly so called,—

Have the bill as long as the head, with the ends of the lamellæ extending to its edges, and appearing like pointed teeth.

[The last-mentioned character is most strongly developed in the Snow Goose (*A. hyperboreus*) of North America, the adult male of which is white, with black primaries. This species rarely straggles into northern Europe. Four

are more or less common in Britain during the winter, the three first of which have been much confused. The colour of all is nearly that of a coloured domestic Goose. The Grey-lag Goose (*A. cinereus*), at once distinguished by the pale grey colour of its rump, which in all the others is dark blackish-brown. The bill also is larger and broader, with more strongly marked lamellæ: the hue of it reddish flesh-colour, tinged with yellowish in summer, with always a white terminal nail to the upper mandible, except when very young; and the legs flesh-coloured. This, which is obviously the origin of the common tame Goose, is at present much the rarest in the British Isles, though it formerly bred abundantly in the fenny counties. The common statement that the male of the tame Goose invariably becomes white in the course of a few years, is untrue. The most nearly allied to it is the White-fronted Goose (*A. albifrons*), considerably smaller, with always a white forehead in the adult, and ordinarily more or less black on the under-parts, appearing in irregular patches; traces of which may likewise be sometimes found in the preceding species: its legs are orange-yellow, and bill flesh-coloured, with a white nail except when very young. This species is very common in winter, but has not hitherto been known to breed here. A still more abundant species is the Bean Goose (*A. segetum*), nearly as large as the first, with orange legs, and narrower bill, generally blackish, with an orange band across it, and a black nail: the latter is very rarely white in aged specimens, which often have the bill nearly wholly yellow, but never quite. The Bean Goose breeds sparingly in Sutherland, and some parts of Ireland. Lastly, the Pink-footed Goose (*A. brachyrhynchus*, Bailon; *A. phænicopus*, Bartl.) is distinguished from the last by its inferior size, and pinkish-red legs, together with its shorter bill, the similar cross-band of which is permanently of a reddish-colour. It is not very common, though more so than the first, and combines the general form of the Bean Goose with the legs of the Grey-lag.]

#### THE BARNACLES—

Are distinguished from ordinary Geese by a shorter and more slender bill, the edges of which conceal the extremities of the laminae, [though there is no drawing the line of separation, and the present division is generally rejected as superfluous.

Two are common in Britain, and found on both sides of the Atlantic, each retiring very far north to breed, more particularly the second species. The Barnacle Goose (*A. leucopsis*); much smaller than any of the preceding, with a grey mantle, the feathers broadly edged with black, a black neck, and white visage: and the Brent Goose (*A. bernicla*), still less, and nearly all black above, with a white spot on each side of the middle of its neck. This bird is one of the finest for the table of the whole tribe. A third (*A. rusticollis*), common on the shores of the Caspian, and as far eastward as Lake Baikal, occurs as a rare occasional straggler, and has the smallest bill of any].

The Egyptian Goose, or Bargander, (*An. ægyptiaca*, Gm.), revered by the ancient Egyptians for the affection it evinces for its young, and remarkable for its display of colours, and for the small spur on the bend of its wing, also pertains to this subgenus: it is sometimes domesticated, but always retains a propensity to return to the wild state. [This species very properly constitutes the division *Chenelopex*, Swainson, and is a modification of the distinct Sheldrake group, all of which belong to the higher division of Geese, and not to the Ducks. There is a single inflated labyrinth at the bottom of its trachea, which, with its plumage, and the character of the down of the young, helps to intimate its real affinities\*.]

#### THE CEREOPSIS (*Cereopsis*, Latham)—

Is a New Holland bird, nearly related to the Barnacles, [so far as the beak alone would indicate,] but with a still smaller bill, the membrane of which is much broader, and extends a little upon the forehead. [This species seldom, if ever, enters the water, and has long legs, which are bare above the joint.]

We only know one, the Grey Cereopsis (*C. cinereus*, Latham), of a grey colour, with black spots, and as large as a tame Goose. [It breeds freely in this country, and possesses a tracheal labyrinth].

#### THE DUCKS, properly so called, (*Anas*, Meyer),—

Have the bill broader than high at its base, and wider at the end than towards the head; the nostrils also more approximated towards its back and base. The shortness and backward position of their legs render their gait upon land more difficult than in the Geese; and they have also a shorter neck, and their trachea is inflated at its bifurcation into cartilaginous labyrinths, of which the left is generally the larger. [They subsist to a greater or less extent on animal diet, and the sexes are always different in colouring, the charge of the young being entirely left to the female, and the male approximating to the female colouring immediately after the breeding season.]

The species of the first division, or those in which the hind toe is bordered by a membrane, have a larger head, a shorter neck, the feet placed further backward, smaller wings, a more rigid tail, the tarsi more compressed, and the toes longer, with more complete webs. They walk with more difficulty, and live almost exclusively on animal food, diving very often. [The plumage is generally moulted once

\* The *A. Magellanica* and *antaretica*, also, referred by the Author to his division of Barnacles, likewise appertain to the Sheldrake group, as shown by their anatomy: their tracheal labyrinths are

figured by M. Eyton. The truth is, that these trivial modifications of the bill are of subordinate value, in the present extensive series. —Ed.

only in the year, the change of colour of the males, about midsummer, taking place without a renewal of the feathers.] Among them we may distinguish

#### THE SCOTERS (*Oidemia*, Fleming)—

By the breadth and inflation of the bill. [Their plumage is chiefly deep black, and they are found almost exclusively in salt water, where they prey mostly on *Testacea*. Feet particularly large.

Two species are not uncommon in the British seas—the Common or Black Scoter (*Anas nigra*, Lin.), entirely black, with an orange protuberance at the base of the bill, and orange-coloured legs; which is the most abundant, and has swollen bronchi; and the Velvet Scoter (*A. fusca*, Lin.), which is larger, with pink feet and black membranes, a white band on the wing, and spot of the same at each eye, its trachea having a sudden box-like enlargement about the middle. A third, allied to the last, the Surf Scoter (*A. peregrinilla*, Lin.), occasionally strays from America, and is distinguished by the triangular patches of white on the crown and occiput: females of all dusky.

The author adds certain species to this genus, with stiff and pointed tail-feathers, forming the *Oxyura*, Bonap.; as the *A. leucocephala*, Pallas; and *A. lobata*, Shaw; which latter, a New Holland kind, is remarkable for a large fleshy appendage hanging under the bill. The *A. rubida* of Wilson is referable to the same natural division.]

#### THE GARROTS (*Clangula*, Leach)—

Have a shorter bill, which is narrower in front: and at their head we place a species with the middle tail-feathers very long, which renders the tail pointed. [This bird, forming the division *Harelda* of Leach, is quite distinct from the others, and moults twice in the year.]

The Long-tailed Hareld (*An. glacialis*, Lin.).—White, with a fulvous spot on the cheek and side of the neck, the breast, back, tail, and point of the wing, black: [scapularies broadly edged with rufous-brown in summer, considerably longer and pure white in winter, when they hang over the wing, as in the Eiders.] Its trachea, ossified towards the base, has on one side four square membranous facets, above which it is inflated into a bony labyrinth. [A very active and noisy marine species, not rare off the coast of Scotland in winter, flying in small flocks. Further north, it becomes exceedingly numerous.]

The Harlequin Garrot (*An. histrionica*, Lin.).—Ash-coloured, the male fantastically streaked with white; eyebrows and flanks rufous. [Also chiefly a marine species, not very closely allied to the remainder.

The rest have a very large head, or which appears, rather, to be so from the fulness of the plumage, and are remarkable for their sexual disparity of size. They are chiefly found in fresh water, and prefer to breed in the hollows of trees, as severally observed by Linnaeus, Hewitson, and Audubon. One is a common winter visitant in Britain].

The Golden-eyed Garrot (*An. clangula*, Lin.).—White, with a black head, back, and tail, a round white spot before each eye, and two white bands on the wing; female ashy, with rufous head: the middle of the trachea is very much enlarged, but preserves its flexibility, and it again becomes singularly widened towards its divarication. [The little Buffed-headed Garrot (*An. albeola*, Lin.), common in North America, is nearly allied].

#### THE EIDERS (*Somateria*, Leach)—

Have a longer bill than the Garrots, ascending higher upon the forehead, where it is cut into by an angle of the feathers; but which is still narrower towards the tip. [These birds are more particularly allied to the Scoters, with which they accord in their exclusively marine habits and food.

There are two species, both with long white scapularies, hanging laterally over the wing, and black and white plumage in the adult male. The Common Eider (*An. mollissima*, Lin.), with a singular green stain on each side of the neck; and the King Eider (*A. spectabilis*), remarkable for a huge protuberance over the base of its upper mandible. Both yield the celebrated Eider down of commerce].

After these separations, there still remain

#### THE POCHARDS (*Fuligula*, Leach),—

The beak of which is wide and flat, but offers no other marked distinguishing character. We possess several species, in all of which the trachea terminates by nearly similar labyrinths, forming a capsule to the left, in part membranous, supported by a framework and ramifications of bone.

[Three are very common in Britain,—the Scaup Pochard (*An. marila*, Lin.), grey, with leaden-coloured bill, and green-black head and neck, which is chiefly found in salt water; the Red-headed Pochard (*A. serina*, Lin.), ash-coloured, with rufous head and neck, and black breast, nearly allied to which, but larger, is the celebrated American Canvas-back (*A. vallinaria*, Wilson); and the Tufted Pochard (*A. fuligula*, Lin.; *F. cristata*, Auct.), purple-black, with pendent occipital crest, and white flanks and belly. A fourth, the White-eyed Pochard (*A. nyroca*, Gm.), is not common, and is distinguished by its maroon head and neck, the latter encircled with a black collar, and a white spot on the chin. A fifth, the Red-crested Pochard (*A. rustina*, Lin.), is larger than any of the foregoing (except the American), with elongated, bright ferrugineous, coronal feathers, and the rest mostly dark: this bird belongs properly to Asia, and is only known as a straggler so far west. Lastly, the Pied Pochard (*An. stellata* and *dispar*), with plumage not unlike that of an Eider, another native of eastern Asia, has likewise

been killed here. Most of these birds are very fine eating, the Scaup least so, and feed (excepting that species) principally on vegetable diet. Their cæca are larger than in nearly all of the foregoing.]

The Ducks of our second division, wherein the back toe is not bordered by a membrane, have a more slender head, the feet less broad, the neck not so long, the bill more even, the body not so thick: they walk better, and feed on aquatic plants and seeds, as well as on animal diet, [as indeed do also the preceding, though generally to a less extent]. It appears that their tracheal labyrinths consist of a homogeneous bony and cartilaginous substance, [which forms a simple vesicle. They all moult twice in the year, the males attaining, by actual change of feather about midsummer, a garb more or less similar to that of the females. They have a considerable dilatation of the œsophagus, and large cæca].



Fig. 131.—Sternum of Teal.

These likewise admit of some subdivisions, [though considerably less strongly marked than the foregoing]; and firstly, we may distinguish that of

#### THE SHOVELLERS (*Rhyncaspis*, Leach).—

The long beak of which is remarkable for its upper mandible forming a perfect half-cylinder, widened at the end. The lamellæ are so long and delicate that they resemble cilia. These birds feed on small worms, which they obtain from the mud at the edge of

brooks, [and are merely true Ducks with the bill a little modified].

The Common Shoveller (*An. clypeata*, Lin.), is a very beautiful Duck, with green head and neck, white breast, rufous flanks, brown back, and wings varied with white, ash-grey, green, brown, &c., which visits us [principally] in the spring. Its flesh is excellent, and tracheal labyrinth small, [the intestines remarkably narrow and elongated]. It is the *Chenerotos* of Pliny.

An Australian species (*An. fasciata*, Shaw), is remarkable for the edge of its beak being prolonged on each side into a hanging membranous flap. [The Shovellers grade into the ordinary Ducks by a succession of species, allied to the British Gargany Duck, which latter retains much of the same character of plumage and colouring.]

#### THE SHIELDRAKES (*Tadorna*, Leach).—

Have the bill very much flattened towards the end, with a projecting boss at the base. [These birds are the most duck-like representatives of an extensive group, found chiefly in the southern hemisphere, and intermediate in their general characters to the present group of Ducks with unlobated hind-toe, and the Geese, but exhibiting none of the essential characters of the former. Like the Ducks, they have always a brilliant speculum of metallic colouring on the wing, and an inflated vesicle, in some single, towards the divarication of the bronchi: but they are exclusively vegetable feeders; the male guards the nest, and protects his brood, uttering with outstretched neck a hissing sound at any intruder; their plumage is moulted but once a year, and undergoes no seasonal change of colour, being generally alike in both sexes, or, when different, the male is white, as in certain Geese; and lastly, they have a gait very different from that of the Ducks, all of them standing high upon the legs, and their young are at first pied, unlike those of other *Lamellirostres*. In all that we have examined, the intestines are particularly long and slender. Their subdivision is not easy; and the common Sheldrake and Egyptian Goose, or Bargander, may be cited as characteristic examples: the wings of most are very similar.

The Common Sheldrake (*An. tadorna*, Lin.; *T. vulpanser*, Auct.).—White, with a green head and neck, a cinnamon-brown cincture round the breast, and black streak down the belly; the wing variegated with black, white, rufous, and green. Common on the shores of the North Sea and of the Baltic, where it nestles in the downs, generally in deserted Rabbit burrows, [and not rare on the British coasts, subsisting on fuci]. The trachea swells into two nearly similar osseous capsules at its divarication.

[Another, of eastern Europe and Asia, the Ruddy Sheldrake (*T. rutila*), has been known to stray westward as far as Britain. It has more the characters of a Goose, and chiefly inhabits the banks of large rivers. Wing like the common species, the rest of its plumage chestnut-rufous, whitish on the head and neck.]

Some Ducks of this second division have naked parts on the head, and often likewise a boss at the base of the beak; as,

The Musk Duck (*A. moschata*, Lin.).—Originally from America, where it is still found wild, and is observed to perch upon trees; it is now very common in our poultry-yards, where it is reared on account of its size. It readily hybridizes with the common species, [producing infertile hybrids]. Its capsule is very large, circular, vertically flattened, and on the right side only. [Its legs are very short, both sexes are alike in plumage, the male guards the nest and brood, and we consider it to be an extreme modification of the group of Sheldrakes.]

Some have the tail pointed.

The Pintail Duck (*A. acuta*).—[A common winter visitant in Britain, highly esteemed for the table; the male with a white mark down each side of the neck, meeting behind. It forms, with another, the needless division *Dafila* of Leach.]

In others, the middle tail-feathers are more or less curled upwards; as,

The Common or Mallard Duck (*A. boschas*, Lin.); known by its orange feet, greenish-yellow bill, the fine changeable green of its neck, separated from the dark maroon colour of its breast by a white ring, &c. In our poultry-yards, it varies like other domestic animals. The wild bird, common in our marshes, nestles among the rushes, in old trunks of willows, and sometimes upon trees. Its trachea terminates below with a great osseous capsule.

Some of them have a crested head, and a bill rather narrower anteriorly, and which, though foreign, are now raised in all our aviaries. [They have smaller feet, perch readily on trees, and surpass all the rest of the tribe in the splendour of their colours. They constitute the *Dendronessa*, Swainson].

Such is the Mandarin Duck (*A. galariculata*) of China, and the Summer Duck (*A. sponsa*) of North America. Their capsules are rounded, and of moderate size.

Other exotic species conjoin to the bill of the Ducks, legs which are even longer than those of the Geese: they perch and nestle upon trees.

[These are the long-legged Whistling Ducks of the West Indies, which pertain to the major division of Sheldrakes, and form the subgenus *Dendrocygnus*.] One of the number has even semipalmated toes.

Lastly, among those which have no particular characteristic, the following visit our shores during the winter.

The Gadwall Duck (*A. strepera*, Lin.), mostly of a lineated grey colour, with some rufous on the wings; the Widgeon (*A. penelope*, Lin.); grey, with a vinaceous breast, and rufous head and neck, the forehead and along the top of the head yellowish-white; the Teal (*A. crecca*), with a rufous head, marked with green on each side, and a spotted breast; and the Gargany (*A. querquedula* and *circia*), with a white stripe behind the eye. [In addition to these, two stragglers have been found in Britain, the Bimaculated Duck, (*A. glaucitans*), from Asia, allied to the Teal, but larger, with a brown head, having two large glossy green spots on each side; and the American Widgeon, with a Teal-like green stripe on the sides of the head (a trace of which is sometimes met with in the common Widgeon), no rufous on the head, a narrower bill, and smaller tracheal capsule. In all these the females have lineated brown plumage, which is characteristic of the true double-moulting Ducks with unlobated hind-toe, and the males are finely rayed across. The habits of all are nearly similar to those of the common species.]

The genus of

#### THE MERGANSERS (*Mergus*, Lin.)—

Comprises species, the bill of which, much more slender and cylindrical than in any of the foregoing, has each mandible armed throughout its length with small pointed teeth like those of a saw, directed backwards, [and which are merely modifications of the ordinary lamellæ]; the tip of the upper mandible is hooked. Their port and even their plumage are the same as in the Ducks, properly so called; but their gizzard is less muscular, and the intestines and coeca are shorter, [though less so than in the Scoters and Eiders. They have a lobated hind-toe, and the plumage is moulted in autumn only, the colours of the male undergoing an extraordinary amount of change towards mid-summer. They do not acquire their adult dress until the second general renewal of the feathers]. The labyrinth at the inferior larynx of the males is enormous, and in part membranous [resembling that of the other Ducks with lobated hind-toe]; and they live on lakes and ponds, where they are very destructive to fish, breeding in similar situations to the common Duck.

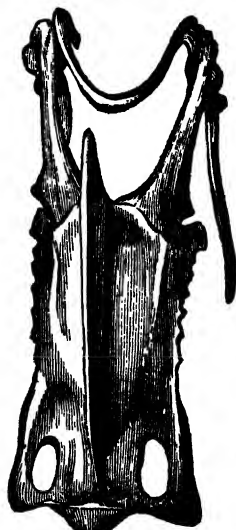


Fig. 133.—Sternum of Merganser.

[Of five species, four are met with in the British Isles, three of them commonly during the winter. All are beautiful birds, at least the males in breeding dress. They are—the Great Merganser (*M. merganser* and *castor*), as large as a Sheldrake, with green head and neck, and short bushy crest, the body white, more or less deeply suffused with saffron, with a blackish mantle, coral bill, and orange legs,—the male; and female rufous-brown, white beneath, with a slender and much longer crest; which retires further north to breed: the Bay-breasted M. (*M. serrator*), size of a Mallard, with a rufous brown breast, spotted with blackish, a green-black head and neck, surmounted with a long thin crest, white ring round the neck, and elegant bordered shoulder-tufts; female very like the last; which breeds on our northern lakes; and



the Hooded M. (*M. cucullatus*), an American species, rare on this side of the Atlantic, the size of a Widgeon, with a very large fan-like crest, white bordered with black. These have two coeca of moderate length, and the trachea of the first presents two successive inflations in its course, which are about equal, the same expansions being also visible in the second species, wherein the higher is however increased, and the lower one diminished, in addition to the labyrinth at the inferior larynx. To this first group would seem also to belong the *M. brasiliensis*, which is peculiar to South America.

Finally, the Smew Merganser (*M. albellus*) is very remarkable for possessing only one minute cœcum, resembling that of a Heron. It is an extremely beautiful bird, proper to the eastern Continent, and not rare in Britain during the winter, the male of which is bright glistening white, variegated with black markings, and the female like that of the others, except that the adult has a black patch before each eye. It retires far north to breed.

The great division of web-footed birds might be naturally arranged into five principal groups, continuatory with those indicated at the close of the series of Waders : viz.—

XI. NATATOIRES (*Swimmers*); including the Flamingo, but corresponding otherwise to the *Lamellirostres* of Cuvier.

XII. MERGITORES (*Immersers*); restricted to the two distinct families of Loons and Grebes.

XIII. PISCATOIRES (*Fishers*); or the *Totipalmati*, which are all exclusively piscivorous.

XIV. VAGATOIRES (*Wanderers*); or the *Longipennes*; containing the two perfectly distinct groups of the Terns, Gulls, and Skuas, and of the Albatrosses and Petrels.

XV. URINATOIRES (*Divers*); more properly so designated; and composed of the separate families of Auks and Penguins.

## THE THIRD CLASS OF VERTEBRATED ANIMALS.

### REPTILIA.

These have the heart so constructed that at each contraction a portion only of the blood received from the various parts of the system is sent into the lungs, the remainder of this fluid returning into the general circulation without having passed through the lungs, and consequently without having been subjected there to respiration.

Hence, it results that the action of oxygen upon the blood is less than in the Mammalia, and that, if the amount of respiration of the latter, wherein the whole of the blood is obliged to pass through the lungs before returning into the system, be expressed as unity, the quantum of respiration of Reptiles should be expressed as a fraction of unity proportionately small, as the quantity of blood propelled into the lungs, at each contraction of the heart, is diminished.

As respiration imparts the warmth to the blood, and the susceptibility of the fibre to nervous irritamen, Reptiles have cold blood, and their aggregate muscular energy is less than in the Mammalia, and much less than in Birds. Hence, their movements can scarcely be performed otherwise than by crawling or swimming: and though several of them leap and run with celerity on certain occasions, their habits are generally sluggish, their digestion excessively slow, their sensations obtuse, and, in cold or temperate climates, they pass nearly the whole winter in a state of lethargy. Their proportionally very diminutive brain is less necessary than in the two preceding classes for the exercise of their animal and vital functions; their sensations seem to be less referrible to a common centre; they continue to live and to execute voluntary movements, for a very considerable while after having been deprived of the brain, and even when the head is severed. The connexion with the [main trunks of the] nervous system is also much less necessary for the contraction of the muscular fibre;



and their flesh preserves its irritability much longer, after having been separated from the rest of the body, than is the case with the preceding classes. Their heart pulsates for many hours after it has been detached, and its loss does not deprive the body of mobility for a still longer period. It has been remarked of some which have the cerebellum extremely diminutive, that this circumstance has some reference to their disinclination to move.

The smallness of the pulmonary vessels enables Reptiles to suspend their respiration without arresting the course of the blood, and thus to remain submerged with less difficulty, and for a longer time, than Mammalia or Birds. The cells of their lungs are not so numerous, as they contain fewer vessels within their precincts, and they are also much larger, these organs having sometimes the form of simple sacs, merely a *little cellular*.

For the rest, Reptiles are provided with a trachea and larynx, although they have not all the power of emitting an audible voice.

Their blood not being warm, they consequently do not require teguments capable of retaining heat; and they are accordingly covered with scales, or simply with a naked skin.

The females have a double ovary and two oviducts, and the males of several genera have a forked or double penis, but in the last order (that of the Batrachians), they have [mostly] none at all.

No Reptile incubates its eggs. In several genera of Batrachians, these are not fecundated until after they have been excluded; they have merely a membranous envelope. The young of this last order have, on quitting the egg, the form and gills of Fishes; and certain genera retain these organs even after the developement of their lungs. In other Reptiles which produce eggs, the Snake, for example, the young is already formed and considerably advanced within the egg at the time the parent deposits it; and there are even some species which may be rendered viviparous at will, by retarding the deposition of their eggs, as M. Geoffroy exemplified by depriving the common Snake of water.

The amount of respiration in this class is not fixed, as in the Mammalia and Birds; but it varies according to the relative proportion of the diameter of the pulmonary artery, as compared with that of the aorta. Thus, Tortoises and Lizards respire much more than Frogs, &c. [though the latter, it should be observed, respire in part over the whole damp skin, as conclusively ascertained by the experiments of Dr. Milne Edwards]. Hence, the differences of energy and sensibility are very much greater than those between one Mammalian and another, or one Bird and another.

Reptiles also present more varied forms, characters, and modes of gait, than the two preceding classes; and it is in their production more especially, that Nature seems to have tried to imagine grotesque forms, and to have modified in every possible way the general plan adopted for all vertebrated animals, and for the oviparous classes in particular.

A comparison of the extent of their respiration with their organs of movement has led M. Brongniart to divide them into four orders, which are as follow :—

The **CHELONIANS** (or Turtles and Tortoises), which have a heart with two auricles, and the body of which, supported by four limbs, is enveloped by two plates or bucklers formed of the ribs and sternum.

The SAURIANS (or Lizards), which have a heart with two auricles, and the body of which, borne on four or two feet, is covered with scales.

The OPHIDIANS (or Serpents), having a heart with two auricles, and the body of which is always deprived of feet. And

The BATRACHIANS, the heart of which has only one auricle; [Prof. Owen has shown that these also possess two]; and which have a naked body, that in the greater number passes, with age, from the form of a Fish respiring by gills, to that of a Quadruped breathing by lungs. Some of them, however, never cast their gills; and there are certain species which have only two feet.

Other authors, as Merrem, have made a different partition of the Saurians and Ophidians. They detach the Crocodiles to form an order [*Loricata*] by themselves, and place the rest of the Saurians with the first family of Ophidians (or that of the Orvets), which mode of distribution is founded on certain peculiarities of the organization of the Crocodiles, and upon a certain affinity of the Orvets for the Lizards. We have deemed it sufficient to indicate these affinities, which are nearly all internal, adopting, nevertheless, a division of more easy application. [In consequence, however, of rejecting this obvious natural arrangement, the Ophidians and Saurians of our author grade into each other; whereas the more intrinsical characters remain inviolate, and indicate three natural groups of *Loricata*, *Saurophidia*, and *Ophidia*.]

## THE FIRST ORDER OF REPTILES,—

### CHELONIA,—

Better known by the appellation of Tortoises [*Testudinata*], have a heart with two auricles, and a ventricle with two unequal chambers, which communicate together. The blood from the body enters the right auricle, and that from the lung the left; but the two streams mingle more or less in passing through the ventricle.

These animals are distinguished, at the first glance, by the double buckler in which their body is inclosed, and which only allows the head and neck, the tail, and the four limbs, to be protruded.

The upper buckler, termed the *carapace* or shield, is formed by the ribs, in number eight pairs, which are widened and joined together, and also to the plates adhering to the annular portion of the dorsal vertebræ, by dented sutures, so that the whole is completely deprived of mobility. The inferior buckler, named the *plastron* or breast-plate, is formed of pieces which represent the sternum, and which are ordinarily nine in number. A frame-work composed of bony pieces, which are believed to have some analogy to the sternal or cartilaginous portion of ribs, and which in one subgenus even remains cartilaginous, surrounds the carapace, and unites all the ribs which compose it. The cervical and caudal vertebræ are alone moveable.

These two bony envelopes are immediately covered by the skin, or by scales; the scapula, and all the muscles of the arm and neck, instead of being attached to the ribs and spine, as in other animals, are all underneath, as are also even the bones of the pelvis and all the muscles of the thigh; so that, in this respect, a Tortoise may be regarded as an animal turned inside-out.

The vertebral extremity of the blade-bone is articulated to the carapace; and its opposite extremity, which may be considered as analogous to a clavicle, is articulated to the breast-plate; so that the two shoulders form a ring, through which pass the oesophagus and trachea.

A third bony ramification, larger than the two others, and directed backwards and downwards, represents, as in Birds, the coracoid apophysis; but its extremity remains free.

The lungs are much extended, and situate in the same cavity with the other viscera. The thorax being in the greater number immoveable, it is by the action of the mouth that the Tortoise breathes, by holding its jaws firmly closed, and alternately depressing and raising the hyoid bone: the first of these movements permits the air to enter by the nostrils; when, the tongue immediately closing their internal aperture, this second operation forces the air into the lungs. The same mechanism occurs in the Batrachians.

Tortoises have no teeth; but their jaws are invested with horn like those of Birds, except in the Chelydes, in which they are merely covered with skin. Their ear-drum and palatal arches are fixed to the skull, and immoveable; their tongue is short, and beset with fleshy papillæ; their stomach simple and strong; their intestines of mean length, and without a cæcum; and they have a very large bladder. The male has a simple penis of considerable size; and the female produces eggs covered with a hard shell. The male may often be recognized externally, by the concave form of the breast-plate.

These animals are very retentive of life, and will continue to move for many weeks after having been deprived of the head. They require very little nourishment, and can pass whole months and even years without eating. Linnæus united them all in the genus of

#### THE TORTOISES (*Testudo*, Lin.),—

Which have been divided into five subgenera, principally after the form and teguments of their carapaces and feet.

#### THE LAND-TORTOISES (*Testudo*, Brongniart)—

Have a bulged carapace, sustained by a bony skeleton wholly solid, and ankylosed for the greater part to the lateral edges of the breast-plate; their legs are truncated, with very short toes connected almost to the nails, and are capable, together with the head, of being completely withdrawn into the armour; the fore-feet have five nails, and the hinder four, all thick and conical. Several species subsist on vegetable matter.

The Greek Tortoise (*T. græca*, Lin.), is that which is commonest in Europe. It inhabits Greece, Italy, Sardinia, and (it would appear) all round the Mediterranean; is rarely a foot long; feeds on leaves, fruit, insects and worms; and burrows a hole in which it passes the winter: it engenders in spring, and lays four or five eggs resembling those of Pigeons.

Among the foreign species, there are several in the East Indies of enormous size, measuring three feet and upwards in length. One is more particularly known as the Indian Tortoise (*T. indica*, Vosm.), of a deep brown colour, with the carapace compressed in front, and its anterior border reverted above the head. Others are remarkable for the pleasing distribution of their colours, as the Geometrical T. (*T. geometrica*, Lin.), a small species with a black carapace, each scale of which is regularly adorned with yellow lines radiating from a disk of the same colour. A nearly similar but much larger kind (*T. radiata*) inhabits New Holland.

Some species (the *Pyxis*, Bell), have the anterior portion of the mouth moveable, as in the Terrapins; and others (the *Kistys* of the same naturalist) can move the hinder part of their carapace, but we have some reason to suspect that this latter conformation is merely accidental.

#### THE EMYDES, or Freshwater Tortoises (*Emys*, Brongniart)—

Have no other constant characters to distinguish them from the preceding, beyond the further separation of their toes, which are also terminated by longer nails, and the intervals between them are occupied by membranes, though they grade even in this particular. They also possess five nails before and four behind. The structure of their feet adapts them to more aquatic habits. The greater number live on insects, small fish, &c.; and their envelope is generally flatter than in the Land-tortoises.

That of Europe (*T. europea*, Schn.; *T. orbicularis*, Lin.), is the most widely diffused, and inhabits all the south and east of Europe as far as Prussia. It attains a length of ten inches, and its flesh is eaten, with a view to which it is fed upon bread and tender herbage; but it also subsists on insects, slugs, small fish, &c. Marsigni states that its eggs require a year to hatch. The Painted Emyde (*T. picta*, Schæff.) is one of the prettiest species, brown, with each scale encircled with a yellow riband, more wide in front. It is found in North America among the reeds, upon the rocks, or on the trunks of trees, from which it falls into the water on being approached. There are very many others.

M. Fitzinger separates, under the name of *Chelodina*, and Mr. Bell under that of *Hydraspis*, those species which have an elongated neck, as *Em. longicollis*, Shaw, &c.

Among the Fresh-water Tortoises may be noticed more particularly,

THE TERRAPINS, or Box-Tortoises, (*Terrapene*, Merrem; *Kinosternon*, Spix; *Cistuda*, Fleming).—The breast-plate of which is divided into two pieces by a moveable articulation, and which have the power of completely closing their carapace when the head and limbs are withdrawn into it.

Some have only the anterior segment of the breast-plate moveable, as *T. subnigra*, Lin., and *T. clausa*, Schæff.; while in others both segments are equally mobile, as *T. tricarinata*, Schæff., and *T. pennsylvanica*, Id.

There are some Fresh-water Tortoises,

THE CHELYDRONS (*Chelydra*, Fitzinger; *Chelonura*, Fleming).—

Which have a long tail and great limbs, that cannot be quite withdrawn within their armour. They approximate to some of the following genera, and more particularly to the Chelydes, and should rank as a particular subdivision.

Such is the Long-tailed Tortoise (*T. serpentina*, Lin.), which is known by having its tail almost as long as the carapace, and beset with denticulated and pointed crests, and pyramidal scales. It inhabits the warm regions of North America, is very destructive to fish and water-fowl, ascends far up the rivers, and sometimes attains a weight of twenty pounds.

THE TURTLES (*Chelonia*, Brongniart; *Caretta*, Merrem).—

Have their envelope too small to receive the head, and more especially the feet, which latter are extremely elongated, (particularly those in front,) flattened to serve as oars, and have all their toes closely united, and enveloped in the same membrane. The two first toes alone of each foot are furnished with pointed nails, and even these are apt to fall, one or the other of them, at a certain age. The pieces which compose their plastron do not form a continuous plate, but are variously denticulated, and leave great intervals, which are occupied only by cartilage. Their ribs are narrowed, and separate one from another at their external portion, but the entire circumference of the carapace is occupied by a circle of pieces corresponding to sternal ribs. The temporal fossa is covered over by an arch formed of the parietals and other bones, in such a manner that the whole head is guarded by a continuous bony casque. The œsophagus is internally armed throughout with cartilaginous points, and sharp tubercles directed towards the stomach.

The Edible or Green Turtle (*T. midas*, Lin.) is distinguished by its greenish scales, to the number of thirty, which do not cover each other in the manner of tiles, and the medial of which are ranged in almost regular hexagons. It attains a length of six or seven feet, and a weight of seven or eight hundred pounds. Its flesh supplies an agreeable viand, very wholesome to mariners traversing the torrid zone. It feeds in great troops upon the algae in the depths of the ocean, and approaches the mouths of rivers to respire. Its eggs, which are deposited in the sand where the sun may warm them, are very numerous, and fine eating; but its shell is not employed in manufactures.

A neighbouring species (*Ch. maculosa*, Nobis,) has the middle plates twice as long as wide, and of a fulvous colour, marked with great black spots; and another (*Ch. lachrymata*, Nobis,) has plates as in the preceding one, but raised into a boss posteriorly, and black splashes upon the fulvous. The scales of both these are useful in manufactures.

The Imbricated Turtle (*T. imbricata*), which is less than the green one, with a more lengthened muzzle and denticulated jaws, and bearing thirteen yellowish and brown scales, which cover each other in the manner of tiles, furnishes the best *tortoise-shell* employed in the arts; but its flesh is disagreeable and unwholesome, though the eggs are very delicate. It inhabits the seas of hot climates.

There are yet two species allied to the Imbricated Turtle, the *Ch. virgata*, Nobis, the scales of which are more raised, and the medial equal, but with more pointed lateral angles, and radiating black lines; and *Ch. radiata*, Schæff., which merely differs from the last by having the hindmost of its middle scales wider, being perhaps a mere variety.

Finally, the Hawk-billed Turtle (*T. caretta*, Gm.) is more or less brown or rufous, with fifteen scales, the medial of which have raised crests, more particularly towards the extremity; the point of the upper mandible is crooked, and the fore-feet longer and narrower than in the others, preserving also better-marked nails. It inhabits several seas, and even the Mediterranean, subsists on Testacea, has bad flesh, and shell which is in low estimation, but it furnishes an oil that burns well.

Merrem has recently distinguished, as

THE LEATHERBACKS (*Sphargis*, Ill.; *Coriudo*, Fleming; *Dermochelis*, Lesueur).—

Those species which have no scales, but the carapace of which is invested with a sort of leather.

Such is a large species of the Mediterranean [which has occurred two or three times on the British shores] (*T. coriacea*, Lin.), the carapace of which is oval, and pointed behind, with three prominent longitudinal ridges. There is another in the Atlantic (*Dermochelis atlantica*, Lefevre).

THE CHELYDES (*Chelys*, Dumeril; *Matamata*, Merrem).—

Resemble the Emydes by their feet and nails; but their envelope is much too small to inclose the

head and feet, which are particularly large; their nose is prolonged into a little trunk; but the most strongly marked of their characters consists in having their widely-cleft mouth not armed with a horny beak, as in other *Testudinata*, but rather resembling that of certain Batrachians, which form the genus *Pipa*.

The *Matamata* (*T. fimbria*, Gm.).—The carapace bristled with pyramidal eminences, and the body fringed all round with laminae, as if cut. An inhabitant of Guiana.

#### THE SOFT TORTOISES (*Trionyx*, Geoff.)—

Have no scales, but merely a soft skin enveloping both the carapace and plastron, neither of which is completely supported by bone, the ribs not reaching to the borders of the carapace, nor being united together for more than a portion of their length, the parts analogous to sternal ribs being replaced by a simple cartilage, and the sternal pieces being partly dented, as in the Turtles, and not covering the whole inferior surface. After death it is perceptible, through the dry skin, that the surface of the ribs is very jagged. The feet, as in the *Emydes*, are palmated without being lengthened, but only three of their toes are provided with nails. The horn of their beak is invested with fleshy lips outside, and their nose is prolonged into a small trunk. The tail is short, and the orifice of the anus beneath its extremity. They inhabit fresh water, and the flexible borders of their envelope assist them in swimming.

The *Trionyx* of the Nile (*T. triunguis*, Forsk and Gm.; *T. aegyptiacus*, Geoff.) is sometimes three feet long, and of a green colour spotted with white; the carapace but slightly convex. It devours the young Crocodiles as soon as they are excluded, and thus renders more service to the Egyptians than even the Mangouste.

The American *Trionyx* (*T. ferox*, Gm.) inhabits the rivers of Carolina, Georgia, Florida, and Guiana; and lies in ambush at the roots of the weeds, seizing on birds, reptiles, &c., and devouring the young Alligators, while itself becomes the prey of the larger ones. Its flesh is good eating. There are several more.

### THE SECOND ORDER OF REPTILES,—

#### SAURIA,—

Have the heart composed, as in the *Chelonia*, of two auricles, and a ventricle sometimes divided by imperfect partitions.

Their ribs are moveable, attached partly to the sternum, and can rise and fall for the purpose of respiration.

Their lung extends more or less towards the hinder part of the body, often penetrates considerably forward below, and the transverse muscles of the abdomen slide under the ribs so far as to entwine the neck. Those in which the lungs are most developed exercise the singular faculty of changing the colours of their skin, according as they are influenced by their wants or by their passions.

Their eggs have an envelope more or less indurated; and the young issue from them with the form which they retain ever afterwards.

The mouth is always armed with teeth; their toes, with very few exceptions, are furnished with nails; the skin is covered with scales more or less serrated, or at least with little scaly granules; and they engender with either a single or double male organ, according to the genus.

All have a tail more or less lengthened, and in nearly every instance very thick at the base: the greater number have four limbs, though some have only two.

Linnaeus arranged them into only two genera, the Dragons and the Lizards; but the latter requires to be divided into several, which differ in the number of feet, of intromittent organs, in the form of the tongue, of the tail, and of the scales, so that we are obliged to separate them even into families. /

The first of these, or that of the CROCODILES, comprises but one genus,—

#### THE CROCODILES (*Crocodilus*, Brongniart),—

Animals of large size, which have the tail flattened at its sides, five toes on the fore-limbs, and four on

the hind, of which the three inward only of each foot are furnished with claws, all of them being more or less connected by membrane; a single row of pointed teeth in each jaw; the tongue flat and fleshy, and attached very near to its edges, which led the ancients to believe that it was altogether wanting; the penis single; the anal orifice longitudinal; the back and tail covered with great square scales of exceeding strength, having an elevated ridge along their middle; and a deeply dented crest upon the tail, double at its base. The scales of the belly are also square, but smooth and narrow. The nostrils, opening at the tip of the muzzle by two small transverse fissures which close as valves, are continued by a long straight canal pierced in the palate bones and sphenoid, as far as the throat.

The lower jaw is prolonged backward beyond the skull, which occasions the upper one to appear moveable, as the ancients asserted to be the case: the latter can only move, however, with the entire head.

The external ear is closed at will by two fleshy lips; and the eye has three lids. Under the throat are two small holes, the orifices of glands, where a musky pomade is secreted.

The vertebrae of the neck are propped together by little false ribs, which render lateral movement difficult: hence these animals cannot readily change their course, and are easily avoided by turning. They are the only Saurians which have no clavicular bones; but their coracoid apophyses are attached to the sternum, as in all the others. Besides the ordinary true and false ribs, their abdomen is protected by others, which do not ascend to the spine, and which appear to be produced by the ossification of the tendinous extremities of the straight muscles.

Their lungs do not penetrate into the abdomen, as in other Reptiles; and the fleshy fibres-adhering to the portion of peritonæum which invests the liver, impart the appearance of a diaphragm; circumstances which, conjoined to the particular of their heart being divided into three chambers, wherein the blood that comes from the lungs does not mingle so completely with that of the body as in other Reptiles, ally these animals somewhat nearer to the warm-blooded quadrupeds.

Their ear-drum and pterogoid apophyses are fixed to the skull, as in the Tortoises.

Their eggs are hard, and the size of those of domestic Geese, whence the Crocodiles are reputed to be, of all animals, those which attain the greatest dimensions considering their size at birth. The females guard their eggs, and continue to protect the young for some months after exclusion.

They inhabit fresh water, and are very carnivorous, but are unable to swallow under water; and their habit is to drown their prey, and then place it in some hole beneath the surface, where they leave it to putrefy before they devour it.

They differ, indeed, so much from other Lizards, that several recent authors have deemed it necessary to make of them a particular order, termed *Lonicata* by Merrem and Fitzinger, and *Emydosaura* by De Blainville.

The species, more numerous than has hitherto been supposed, fall into three distinct subgenera.

#### THE GAVIALS, CUV.—

Have the muzzle slender, and very much elongated; the teeth about equal; the hind-feet dented at their external edge, and webbed to the ends of the toes; two great perforations in the bones of the skull behind the eyes, which may be discerned outside the skin. They have only been observed on the eastern continent.

That of the Ganges (*Lac. gangetica*, Gm.), which attains a large size, is remarkable, not only for the length of its muzzle, but for a large cartilaginous prominence surrounding the nostrils, which throws these backwards, and led Ælian to assert that the Gangetic Crocodile had a horn at the tip of its snout.

#### THE CROCODILES, properly so called,—

Have the muzzle oblong and flattened, the teeth unequal, but resemble the Gavials in other respects. Some of this form occur on both continents.

#### THE CAYMANS, or Alligators (*Alligator*, Cuv.)—

Have a broad and obtuse muzzle, and uneven teeth, the fourth below entering into cavities of the upper jaw, and not the interstices of the upper teeth, as in the preceding; their feet are only semi-palmated, and undented; and the species are only known to inhabit America.

## THE SECOND FAMILY OF THE SAURIANS,—

## THE LIZARDS,—

Is distinguished by its slender, extensible, and forked tongue, as in the Snakes; by its lengthened body and rapid gait; the feet have each five toes furnished with claws, which are separate and unequal, more particularly those behind; their scales, under the belly and around the tail, are disposed in parallel transverse bands; their tympanum, which is on the upper part of the head, is membranous and shallow; a production of the skin, split longitudinally, and which closes by a sphincter, protects the eye, beneath the front angle of which is a vestige of a third eyelid; their false ribs do not form a complete circle; the males have a double penis; and the anus is a transverse aperture.

The species are very numerous and much varied, and we subdivide them into two great genera.

THE MONITORS (recently termed, by a singular mistake, *Tupinambis*),—

Are the largest of the whole tribe; they have teeth in both jaws, but none on the palate, and the greater number have the tail laterally compressed, in adaptation to aquatic habits. Frequenting the vicinity of the haunts of Crocodiles and Alligators, it is said that they give warning, by a whistling sound, of the approach of those dangerous reptiles, and hence, probably, their names of *Sauvegarde* and *Monitor*, though this is not quite certain.

They divide into two distinct groups. The first, or that of

## THE MONITORS, properly so called,—

Are known by their numerous small scales upon the head and limbs, the belly, and around the tail, which latter has a keel above, composed of a double range of projecting scales. Their thighs do not exhibit that range of pores found in most other Saurians. All are from the ancient continent.

Two species, in Egypt, have been considered the types of separate subdivisions; the Nilotic *M. (Lac. nilotica*, Lin.), of *Varanus*, and the Ground *M. (L. scincus*, Merrem), of *Psammosaurus*, both of Fitzinger. Africa and India produce many more, with sharper teeth and still more compressed tail.

The other group of Monitors has angular plates upon the head, and great rectangular scales upon the belly and around the tail. The skin of their throat is invested with small scales, and forms two transverse folds. They have a range of pores on the inside of each thigh. Two subdivisions are required.

The first, or that of

THE DRAGONETS (*Crocodilurus*, Spix; *Ada*, Gray),—

Is distinguished by caudal crests, like those of the Crocodiles, formed of raised scales; their tail is compressed. Such is

The Great D. of Guiana (*M. crocodilurus*, Merr.), which attains a length of six feet, and is eaten. There are various others in the hot regions of America.

THE RESTRICTED MONITORS (*Monitor*, Fitzinger),—

Have no keeled scales either on the back or tail; their teeth are denticulated, but with age the hind-most become rounded.

Some, more particularly termed *Sauvegardes*, have the tail more or less compressed, and the belly scales longer than broad; they frequent the borders of water. One, in Brazil and Guiana, attains to six feet in length. It runs swiftly on the ground, and takes to the water when pursued, into which it plunges, but does not swim; it devours all sorts of insects, reptiles, the eggs of poultry, &c., and nestles in holes which it burrows in the sand. Its flesh and eggs are eaten.

Others, termed *Amava*, merely differ in having a round tail, covered, as is also the belly, with transverse ranges of keeled scales, which on the belly are broader than long. They are American animals, which resemble our Lizards extremely, but, besides wanting molar teeth, the greater number have no collar, and all have minute scales on the throat; their head, also, is more pyramidal than in the Lizards, and they have no bony plate over the orbit.

## THE LIZARDS, properly so called,—

Form the second great genus of this tribe. They have the back portion of the palate armed with two ranges of teeth, and are otherwise distinguished from the preceding animals by a collar round the neck, which is formed by a transverse range of broad scales, separated from those of the belly by a space covered with small ones like those of the throat, and also by a part of the bones of the skull advancing over the temples and orbits, so that the whole head is defended by a bony casque.

The species are very numerous, and many are found in Europe [though two only in this country, *L. agilis*, which is comparatively rare, and *L. vivipara*, which, unlike the other, is ovoviporous, as in the Vipers, and extremely

common upon heaths and sunny banks. One of a beautiful green colour, (*L. viridis*), is common over the south of Europe, and in the Channel Islands.]

The division *Algyra*, Cuv., has the dorsal and caudal scales carinated; those of the belly imbricated and smooth and no collar round the neck.

*Tachydromus*, has square carinated scales upon the back, under the belly, and on the tail; neither collar nor femoral pores; but on each side of the anus is a small vesicle, opening by a pore. Their body and tail are very much elongated, and the tongue still longer than in the Lizards.

### THE THIRD FAMILY OF THE SAURIANS,—

#### THE IGUANA GROUP,—

Have the general form, long tail, and few and unequal toes of the last series; the eye, ear, double penis, and anus, also similar; but their tongue is thick, fleshy, and non-extensible, and is notched only at the tip. They fall into two sections; the first having no palatal teeth, in which the following genera are arranged.

#### THE STELLIONS (*Stellio*, Cuv.)—

Which, with the general characters of this family, have the tail encircled with rings of large scales, that are often spinous. The subgenera are as follow.

*Cordylus*, Gronov., which have not only the tail, but the belly and back covered with large scales, transversely arranged. Their head, as in the common Lizards, is protected by a bony casque, and covered with plates. In several species, the points of the caudal scales form spinous circles; there are, also, little spines on those of the sides, the back, shoulders, and outside of the thighs. The latter have a line of large pores.

*Stellio*, Daud.—Caudal spines middle-sized; the head posteriorly swollen by the muscles of the jaws; the back and thighs bristled with scales larger than the others, and sometimes spinous; little groups of spines encircling the ear; no femoral pores, and the tongue lengthened to a point. But one species is known, which inhabits the Levantine countries, where it is persecuted by the Mahometans, who conceive that it mocks their actions when praying.

*Doryphorus*, Cuv.—No femoral pores, as in the last, but the trunk not bristled with groups of spines.

*Uromastix*, Cuv., have merely the head not swollen, and all the body-scales small, uniform, and smooth, but those of the tail are still larger and more spinous than in restricted *Stellio*, though there are none underneath it. A series of pores beneath the thigh.

#### THE AGAMAS (*Agama*, Daud.)—

Have a great resemblance for the restricted Stellions, especially in the bulging of the head; but their imbricated and not verticillated caudal scales distinguish them. The maxillary teeth are nearly the same, and there are none on the palate. In

The Ordinary Agamas, the scales, raised into points or tubercles, are alike bristled on various parts of the body, and especially round the ear, into spines that are sometimes grouped, and sometimes isolated. Occasionally, there is a range round the neck, but they never form the crest which characterises the Galeotes. The skin of the throat is lax, folded across, and susceptible of inflation. Some only have femoral pores.

The Tapays are merely Agamas, which, with a swollen belly, have a short and slender tail.

*Trapelus*, Cuv., have all the scales small and spineless, and no femoral pores. That of Egypt changes colour as readily as the Chameleon.

*Leiolepis*, Cuv., has the head less swollen, and is wholly covered with small and smooth serrated scales. It has femoral pores.

*Tropidolepis*, Cuv., is uniformly covered with square, imbricated scales, and has the series of femoral pores strongly marked.

*Leposoma*, Spix., differs only from the last in the absence of the pores.

The Galeotes, (*Galeotes*, Cuv.), are regularly covered with imbricated scales, often square and pointed, over the whole body, limbs, and tail, which last is very long; those of the middle of the back being more or less raised and compressed into spines, forming a crest of varying length.

*Lophyrus*, Dumeril, have a compressed tail, and dorsal crest still higher than in the last, from which they differ in possessing femoral pores.

*Gonocephalus*, Kaup., have also a sort of disc on the skull, formed by a crest which terminates by a dentation before each eye. They likewise have a throat-appendage and nuchal crest. The tympanum is visible.

*Lyriocephalus*, Merrem, conjoin to the characters of *Lophyrus* that of having the tympanum couched under the skin and muscles, as in the Chameleons. They have also a dorsal crest and keeled tail.

*Brachylophus*, Cuv., have small scales, a nuchal and dorsal crest but slightly projecting, a small throat-appendage, femoral pores, and general aspect of the Iguanas; but no palatal teeth, and those of the jaws denticulated.

*Phrygnathus*, Cuv.—The head bulged backwards, without any throat-appendage, and a crest of great pointed scales along the back and tail, which last is much compressed.

#### THE ISTIURES (*Istiurus*, Cuv.; *Lophura*, Gm.)—

Are characterized by a raised and trenchant crest, which extends over a part of the tail, and is sus-



tained by long spinous vertebral apophyses; this crest is scaly like the rest of the body; the belly and caudal scales are small, and approach a little to a square form; the teeth are strong, compressed, and undenticulated, and are found only on the jaws; there are femoral pores, and the skin of the throat is lax, without forming an appendage.

#### THE DRAGONS (*Draco*, Lin.)—

Are known at the first glance from all other Saurians, by their first six false ribs, instead of encircling the abdomen, being extended in a straight line, so as to support a production of the skin, which forms a sort of wing, and acts as a parachute when the animal leaps from bough to bough. They are small-sized reptiles, everywhere covered with minute imbricated scales, those of the tail and limbs being keeled. Their tongue is fleshy, but slightly notched and little extensible. Beneath the throat is a long pointed [inflatable] appendage, sustained by the hyoid bone, and laterally by two other small bones. The tail is long; the thighs have no pores; and there is a slight dentelation on the neck. Each jaw has four small incisors, flanked by a long and pointed canine, behind which are a dozen triangular and trilobate molars.

They have, therefore, the scales and throat-appendage of the Iguanas, with the head and teeth of the Stellions. All the known species are from the East Indies.

*Sitana*, Cuv., differs in the non-prolongation of the ribs, and by having an enormous throat-appendage, which reaches to the middle of the belly, and is more than double the height of the animal.

It is perhaps to this tribe of Agamas that we should approximate a most extraordinary fossil reptile, the remains of which are imbedded in the Jura limestone,—

#### THE PTERODACTYLUS, Cuv.

It had a very short tail, a very long neck, and very large head; the jaws armed with even and pointed teeth; but its principal character consisted in the excessive elongation of the second toe of its fore-feet, which extended twice the length of the trunk, and probably [undoubtedly] served to sustain some membrane by which the animal was enabled to fly, similar to that which the ribs of the Dragon support.

The second section of the family of Iguanas, or that of the Iguanas proper, is distinguished from the preceding by the existence of palatal teeth.

#### THE IGUANAS, properly so called, (*Iguana*, Cuv.)—

Have the body and tail covered with small imbricated scales; a range of spines along the back, or of raised, compressed, and pointed scales, and under the throat a compressed and pointed appendage, the edge of which is sustained by a cartilaginous production of the hyoid bone. The thighs have the same range of porous tubercles as in the Lizards proper, and their head is covered with plates; each jaw is surrounded by a range of triangular, compressed teeth, with denticulated edges; and there are also two little ranges at the back of the palate.

A species common in all tropical America (*Lac. iguana*, Lin.), which grows to four or five feet in length, is esteemed very fine eating, though hurtful in syphilitic disorders. It lives chiefly upon trees, occasionally enters the water, and subsists on fruit, grain, and leaves. The female deposits eggs in the sand as large as those of a Pigeon, which are agreeable to the taste, and almost without white. Several others inhabit the same countries.

#### OPHRYESSA, Boié.

Small imbricated scales, a slightly projecting dorsal crest prolonged over the compressed tail, palatal teeth, and denticulated maxillary teeth which approximate it to the Iguanas, but no throat-appendage nor femoral pores.

#### THE BASILISKS (*Basiliscus*, Daud.)

No femoral pores, but palatal teeth as in the last; the body covered with small scales; and a continuous elevated crest along the back and tail, which supports spinous vertebral apophyses as in the tail of *Istiurus*.

#### THE MARBLETS (*Polychrus*, Cuv.)—

Have palatal teeth, and femoral pores, like the Iguanas, but which are inconspicuous: their body, however, clad with small scales, is not crested; the head is covered with plates; tail long and sharper-edged; the throat extensile, forming an appendage at the will of the animal; and they change colour like the Chameleons, having a very voluminous lung, which fills nearly the whole body, and subdivides into numerous branches; their false ribs also surround the abdomen, as in the Chameleons, and unite to form complete circles.

## THE ECPHIMOTES, Fitz.

Teeth and pores of the preceding, but small scales on the body only; those of the tail, which is thick, being large, pointed, and keeled; head plated; general form somewhat short and flattened, as in certain *Agamis*, rather than attenuated as in the *Marblets*.

## OPLURUS, Cuv.,—

Differs from the last in wanting femoral pores, with keeled and pointed caudal scales, which approximate this group to the *Stellions*; the dorsal scales are also keeled and pointed, but very small.

THE ANOLIS (*Anolis*, Cuv.)—

To the general form of the *Iguanas*, and especially of the *Marblets*, conjoin a very peculiar distinctive character; the skin of their toes widening under the antepenultimate phalanx into an oval disk, striated across underneath, so as to attach to different kinds of surfaces, over which they creep with much facility by means of their very crooked claws. The body and tail are uniformly roughened with minute scales, and the greater number have a goitre-like appendage under the throat, which inflates and changes colour with the passions of the animal, and during the season of copulation. Several of them at least equal the *Chameleon* in the facility with which they vary the colours of their skin. Their ribs unite beneath into complete circles, as in the *Chameleons* and the *Marblets*. Their teeth, as in the *Iguanas* and *Marblets*, are trenchant and denticulated, and they have the same range of them on the palate. The skin of the tail wrinkles into slight folds, each containing some circular ranges of scales. This genus appears to be peculiar to America.

Some have a caudal crest sustained by spinous vertebral apophyses, as in the *Istiures* and *Basilisks*; while others have a round tail, or which is only a little compressed.

It is to this family of *Iguanians* with palatal teeth, that the enormous fossil reptile of *Maestricht* appertains, to which the term *Mososaurus* has been applied; the *Geosaurus* of *Soemmering*, also, the *Megalosaurus* of *Buckland*, and the *Iguanodon* of *Mantell*, with certain others, all of immense size, appear to approximate this same family; but their characters are not sufficiently known to class them with certainty.

## THE FOURTH FAMILY OF THE SAURIANS,—

## THE GECKOTIANS,—

Consists of nocturnal species, so similar that they may be all left under a single generic head,—

THE GECKOS, Daud. (*Stellio*, Schneider.; *Ascalabotes*, Cuv.).

These have not the attenuated form of the *Lizards* already treated of, but, on the contrary, are flattened; more particularly on the head, and have the feet of mean length, and the toes nearly equal; their gait is slow and stately; their very large eyes, the pupil of which shrinks from the light, as in the *Cats*, indicate them to be nocturnal creatures, which pass the day in obscure places; their very short eyelids retreat altogether between the eye and orbit, which imparts a different physiognomy from that of other *Saurians*; their fleshy tongue is not extensible; their tympanum a little deepened; their jaws are armed all round with one range of minute serrated teeth; their palate toothless; their skin is roughened above with minute granular scales, among which are often some larger tubercles, and is covered on the under parts with somewhat less diminutive flat and imbricated scales. Some have femoral pores. The tail has circular folds, as in the *Anolis*; but, when it has been severed, it is reproduced without folds, and even without tubercles, which has led to a multiplication of the species.

This genus is very numerous, and is diffused over the hot regions of both continents. Their tardy and sombre aspect imparts a certain resemblance to the *Toads* and *Salamanders*, and have hence caused them to be disliked, and accused of being venomous without any proof that they are so.

The greater number have the tarsi widened throughout or in part, and marked underneath with very regular folds of the skin, which enable them to adhere to surfaces, so as to walk even on ceilings. Their claws are variously retractile, and preserve their sharp points; which circumstance, in conjunction with their eyes, has led to their being compared to the *Cats* among mammiferous animals; these claws, however, vary in number according to the species, and in some are wanting altogether.

The first and most numerous subdivision of the *Geckos*, which I name *Platydictyles*, have toes widened throughout their length with transverse scales underneath; some have claws on all their toes, and very small thumbs. They are handsome animals, with bright colours, and are entirely covered with tubercles. The different known species inhabit the *Mauritius*. There are some with femoral pores, and others without, and among the latter some with fewer or no claws.

A second subdivision is formed of the *Hemidactyles*, which have an oval disk at the base of their toes, formed by a double range of chevron scales underneath; the middle of this disk elevates the second phalanx, which is slender, and bears the third, with its claw, at the extremity. The known species have all five claws, and the range of pores on either side of the anus; the scales underneath the tail form broad bands, as in the true *Serpents*.

A third subdivision, which I style *Thecadactyles*, have toes widened throughout their length, and furnished with transverse scales underneath, but which latter are divided by a deep longitudinal groove, into which the claw retracts completely. Those known to me have the thumb alone clawless, no femoral pores, and the tail covered with little scales both above and below.

The fourth subdivision of *Geckos*, I term *Ptyodactyles*. These have only the ends of their toes dilated into plates, with a fan-like structure beneath; the middle of the plate being split, and the claw placed in its fissure. They have very crooked claws on all their toes.

Some have a round tail, and five toes; while others have the tail bordered with a membrane on each side, and the toes palmated. It is probable that the latter are aquatic, and they are the *Uroplates* of Dumeril.

A fifth subdivision is composed of the *Sphero-dactyles*,—which are certain small *Geckos*, the ends of the toes of which are terminated by a little palette without folds, but the claws of which are always retractile. Those in which the palette is double, or emarginated in front, approximate the round-tailed *Ptyodactyles*. More frequently, however, the palette is round and simple. All the known species are from India and the Cape.

Finally, there are certain of these *Saurians* which, with all the other characters of the *Geckos*, have the toes not widened. Their claws, five in number, are nevertheless retractile. Some of these, with a round tail, and the toes striated beneath, having dented edges, constitute the *Stenodactyles*;—and there are others with slender and naked toes, and also a round tail, which are the *Gymnodactyles* of Spix.

Some, again, have the tail horizontally flattened, in the form of a leaf, which I denominate *Phyllurus*.

One species only is as yet known, from New Holland.

## THE FIFTH FAMILY OF THE SAURIANS,—

### THE CHAMELEONS (*Chamaleo*, Lin.),—

Are so very distinct from the other *Saurians* that it is not easy to intercalate them in the series.

All have the skin roughened with little scaly granules; the body compressed, and the dorsal line sharp; tail round and prehensile; five toes on each foot, but divided into two opposite sets, one consisting of two toes, and the other the remainder,—the toes of each of these sets being connected by skin as far as the nails; the tongue is fleshy, cylindrical, and extremely protrusile; the teeth trilobate; the eyes large, but almost covered by the skin, which leaves only a little aperture opposite the pupil, and they are moveable independently one of the other; the ear not visible externally, and the occiput pyramidically raised. Their first ribs are joined to the sternum, and the remainder are each continued to join the corresponding rib of the other side, encircling the abdomen by complete hoops. The lung is so vast that, when inflated, the body appears transparent, and induced the ancients to believe that these animals fed upon air. They subsist on insects, which they take with the glutinous extremity of the tongue, which organ is the only part of them that moves quickly. The motion of the limbs is excessively slow. The magnitude of the lung is probably the indirect cause of their changing colour, which does not take place, as is currently supposed, for the purpose of assimilating them to the proximate surfaces, but according to their wants and passions. Their lung, in fact, renders them more or less transparent, by forcing the blood more or less into the vessels of the skin, the colour even of this fluid being more or less vivid according as the lung is distended with air. They are constantly found upon trees.

[These most singular animals are particularly remarkable for the diminished sympathy of the two sides of their whole frame, one of which may be asleep and the other awake, one of one colour and the other of another, &c.,—the separate movement of their eyes being merely another phase of the same phenomenon: hence it is remarkable, that, unlike most other animals, the Chameleon is totally unable to swim, from the incapability of its limbs of acting in due concert.]

## THE SIXTH FAMILY OF THE SAURIANS,—

### THE SCINDOIDIENS,—

Are recognized by the shortness of their feet, the non-extensibility of the tongue, and the equality of the tile-like scales which cover the whole body and tail.

### THE SCINQUES (*Scincus*, Daud.)—

Have four very short feet, a body of nearly the same calibre with the tail, no occipital bulge, no crest or throat appendage, and the scales uniform and shining, and disposed tile-fashion like those of a *Carp*.

Some have a spindle-shape; and others, which are nearly cylindrical, and more or less elongated, resemble Snakes, and more particularly the Orvets (*Anguis*), with which they have many internal points of relationship, and which thus grade from the family of Iguanas by an uninterrupted series of transitions. For the rest, the tongue of this genus is fleshy, and but slightly extensible and notched; and the jaws are armed all round with small serrated teeth. The remainder of their conformation approximates more or less to that of the Iguanas and Lizards, and all their toes are unguiculated and free. Certain species have palatal teeth, and a dented anterior border to the tympanum, while others (the *Tiliqua*, Gray) have no teeth to the palate.

#### THE SEPS (*Seps*, Daud.)—

Merely differ from the Scinques by having the body still more elongated, almost like that of an Orvet, and the feet still smaller, the fore and hind being also more separated from each other. Their lungs begin to exhibit some irregularity.

#### THE DIPODES (*Bipes*, Lacep.)—

Compose a small genus, which only differs from Seps by the total absence of anterior limbs, merely retaining the scapulars and clavicles buried beneath the skin, and the hind feet alone being visible. There is but one step from them to the Orvets. Some have a range of pores on each side of the anus, which is not found in others.

#### THE CHALCIDES (*Chalcis*, Daud.)—

Are very elongated and snake-like Lizards, like the Seps; but their scales, instead of being disposed tile-fashion, are rectangular, and form transversal bands on the tail, like those of ordinary Lizards.

Some have a groove along each side of the trunk, and the tympanum still very apparent. They approximate the Cordyles, as the Seps do to the Scinques, and lead, in a variety of ways, to the Pseudopodes and Ophisauræ. Others have a concealed tympanum, and conduct to the Chirotæ, and thence to the Amphibænes.

#### THE CHIROTÆ (*Chirotæ*, Cuv.)—

Resemble the last by their verticillated scales, and still more the Amphibænes, by the obtuse form of the head; but are distinguished from the former by the absence of hind feet, and from the latter by the existence of fore-feet.

The only species (*C. tumbricoides*) inhabits Mexico, and has all the internal organization of an Amphibæne, with femoral pores, and one great lung and the vestige of a second, as in most Ophidians.

In fact, the genera which terminate this order of Saurians interpose in so many ways between the ordinary Saurians and the genera placed at the head of the Ophidians, that many recent naturalists object to separating the two orders, or at least establish one comprised of the Saurians in part, detaching the Crocodiles, and another of the Ophidians pertaining to the family of *Anguis*; but among the fossils of the ancient limestone formations are found two very extraordinary extinct genera, which, with the head and trunk of a Saurian, have feet borne on short limbs, and composed of a multitude of little articulations, which form in the aggregate a sort of fin or swimming-paw, analogous to those of Cetaceans. The first of these genera, or that of

#### THE ICTHYOSAURUS,—

Had a large head and short neck, enormous eyes, middle-sized tail, and elongated jaws armed with conical teeth, inserted in a groove.

Several species are found in England, France, and Germany, some of immense size.

The other genus, or

#### THE PLESIOSAURUS,—

Had a small head, and extremely long serpent-like neck, composed of more cervical vertebræ than that of any other known animal. Its tail was short, and its remains are found in the same calcareous strata.

These two genera, for a knowledge of which we are principally indebted to the researches of Messrs. Home, Conybeare, Buckland, &c., were inhabitants of the sea. They should form a very distinct family, but what is known of their osteology approaches more to that of the ordinary Saurians than the Crocodiles, with which latter they have been gratuitously associated by M. Fitzinger, since neither their tongue nor scales are known, which are the two most distinctive characteristics of the *Loricata*. [It has since been ascertained that they were covered merely with skin, apparently as in the Batrachians; and there is reason to suspect that the Ichthyosaur possessed a cartilaginous dorsal fin, as in many of the true *Cetacea*.]

## THE THIRD ORDER OF REPTILES.

## THE SERPENTS (OPHIDIA).

These have no feet, and are consequently, of all others, the *Reptiles* which most merit the name. Their extremely elongated body progresses by means of folds pressed backwards against the ground. They divide into three families.

## THE FIRST FAMILY OF OPHIDIANS,—

## THE ORVETS—

Retains the skull, teeth, and tongue of the preceding group of *Seps*, and the eye has three lids, &c. whence they are merely *Seps* without feet. Such are

THE ORVETS (*Anguis*, Lin.),—

Externally characterized by imbricated scales, which cover them all over. We subdivide them into four subgenera, the three first of which have a shoulder-bone and pelvis beneath the skin.

The *Pseudopodes* (*Pseudopus*, Merrem) have the tympanum visible externally, and a small prominence on each side of the anus, which contains an ossicle analogous to a femur, articulated to a true pelvis beneath the skin; the anterior limbs are only represented by an inconspicuous depression, and have no internal humerus. One of the lungs is a fourth shorter than the other. The scales are square, thick, and semi-imbricated, and between those of the upper and lower parts is a groove of smaller scales on each side.

The *Ophisaur*s (*Ophisaurus*, Daud.), merely differ in the absence of external rudiments of limbs, but retain the tympanum, and have one lung a third shorter than the other.

The *Orvets* (*Anguis*, Cuvier), have no trace of limbs externally visible, and their tympanum even is couched beneath the skin; their maxillary teeth are crooked and compressed, and they have none on the palate. The body is surrounded with imbricated scales, without any lateral fold, as in the preceding; and one of the lungs is shorter by half than the other. [A species, known as the *Slow-worm*, or *Blind-worm*, is of common occurrence in Britain, and throughout Europe. When alarmed, it constricts its muscles, and is then singularly brittle.]

These three subgenera have still an imperfect pelvis, a small sternum, scapulars, and also clavicles, hidden beneath the skin; and the absence of these several bones characterizes

The *Acontias* (*Acontia*, Cuv.), which, in the structure of their head and eye-lids, still resemble the preceding; their anterior ribs are connected all round, beneath the trunk, by cartilaginous prolongations; and they have one middle-sized lung, and another very short one. Their teeth are small and conical, and I think that I have perceived some on the palate. They are easily known by having the muzzle closed by a sort of mask.

## THE SECOND FAMILY OF OPHIDIANS,—

## THE TRUE SERPENTS,—

Which is much more numerous, is composed of genera with neither sternum nor vestige of shoulder, but the ribs of which still encircle a great part of the trunk, and the vertebræ are still articulated by a convex facet applied to a concave facet of the succeeding one. They have no third eyelid, nor tympanum; but the small bone of the ear exists beneath the skin, and its handle passes behind the tympanic bone. Several have also, under the skin, a vestige of hind-limbs, which in some even shows itself externally in the form of a small hook.

We subdivide them into two tribes.

That of the *DOUBLE-MARCHEURS* [which progress either head or tail foremost,] have still the lower jaw fixed as in all the preceding Reptiles, by a tympanic bone, articulated direct to the cranium, the two rami of this jaw ankylosed at the symphysis, and those of the upper fixed to the skull, and to the intermaxillaries; so that their swallow cannot dilate as in the following tribe, and their head is of even size with their whole body; a form which enables them to progress backwards or forwards with the same facility. The bony frame of the orbit is incomplete behind, and the eye is very small. Finally, their body is covered with scales, the anus very near its extremity, the trachea long, and the heart placed far backwards. None of them is known to be venomous.

There are two genera, one of which approximates to the *Chalcides* and *Bimanes*, and the other to the *Orvets* and *Acontias*.

THE AMPHISBÆNES (*Amphisbæna*, Lin.)—

Have the whole body surrounded with circular ranges of square scales, as in the *Chalcides* and *Bimanes*

among the Saurians ; a range of pores before the anus ; the teeth few, conical, and growing only from the jaw, none from the palate ; and they have only one lung.

There are three or four species, which live on insects, and are found principally about ant-hills, a circumstance which has induced the opinion that they subsist chiefly upon Ants. They are oviparous. .

#### THE TYPHLOPS (*Typhlops*, Schneider).—

Have the body covered with small imbricated scales, like the Orvets, with which they were long arranged ; the muzzle prolonged and plated ; the tongue rather long and forked ; the eye reduced to a point, scarcely visible through the skin ; the anus nearly at the extremity of the body ; and one lung four times as large as the other. They are small species, resembling Earth-worms at the first glance, and are found in the hot regions of both continents.

Some have the head obtuse and even with the body, resembling packthread at both ends. Others have the muzzle depressed and obtuse, with scaly plates anteriorly. Some, again, have the fore-part of the muzzle covered with a single broad plate rather sharp in front. And there are others in which the muzzle terminates in a little conical point, being also totally blind : the posterior extremity of these is enveloped in a bony oval buckler, and they were formerly ranged with the Orvets, on account of their small scales.

The other tribe, or that of the SERPENTS properly so called, have a tympanic bone or pedicle to the lower jaw, which is moveable, and nearly always suspended by another bone analogous to the mastoid, which latter is attached to the skull by muscles and ligaments, that allow it also to be moveable. The branches of this jaw are not united together, and those of the upper are connected by ligaments only to the intermaxillaries ; so that they can open more or less, which imparts to these animals the capability of dilating the mouth, so as to swallow objects of greater bulk than themselves.

Their palatal arches partake of this mobility, and are armed with recurved and pointed teeth, which is the most marked and constant character of this tribe ; their windpipe is very long ; the heart placed far backward ; and the greater number have only one great lung, with the vestige of a second.

They divide into venomous and non-venomous, and the former of these into venomous having several maxillary teeth, and into venomous with isolated fangs.

In the non-venomous, the branches of the upper jaw are furnished throughout their length, like those of the lower jaw and the palate, with fixed and solid teeth. There are three or four subequal ranges of these teeth in the upper part of the mouth, and two in the lower.\* Those among them which have the mastoid bones inclosed within the cranium, the orbit incomplete behind, the tongue short and thick, and which resemble the *Double-Marcheurs* in the cylindrical form of their head and body, were formerly classed with the Orvets, on account of their diminutive scales.

#### THE ROLFS (*Tortrix*, Oepel ; *Torquatrix*, Gray ; *Ilysis*, HEMP).—

Are externally distinguished from the Orvets by the range of scales along the belly and beneath the tail being rather larger than the others, as also by the extreme shortness of the tail. They have but one lung. All are from America.

The *Uropeltis*, Cuv. (*Anilius*, Oken), is an allied new genus, the tail of which, still shorter and obliquely truncated above, is flat and beset with little scales at the truncation. Their head is very small ; the muzzle pointed ; they have a range of scales under the tail, a little larger than the rest, and a double range beneath its truncate portion.

The non-venomous Serpents which, on the contrary, have detached mastoid bones, and the jaws of which are dilatable, have the occiput more or less bulged, and the tongue forked and very extensible.

Two principal genera have long been distinguished,—the Boas and the Snakes proper.

#### THE BOAS (*Boa*, Lin.).—

Formerly comprehended all Serpents, venomous or not so, the under-part of the body and tail of which is covered with scaly transverse bands, each of a single piece, and which have neither spur nor rattle at the tip of the tail. Being very numerous, it is necessary to subdivide them, after abstracting the venomous ones.

\* The common opinion is, that all Serpents destitute of pierced fangs in the lower part of the jaw, are non-venomous ; but this I have some reason to doubt. All have a maxillary gland, often very large ; and the back-molars frequently exhibit a groove, which would seem to conduct some liquor. This much is certain, that various species, the

back-molars of which are very large, are reputed to be extremely venomous in the countries which they inhabit ; an opinion which is confirmed by the experiments of Lalande and Leschenault, which it is desirable should be repeated.

The Boas more particularly so named, have a hook on each side of the anus ; a compressed body, larger towards the middle ; a prehensile tail ; and small scales, at least on the hinder part of the head. Among them are found the largest of all Serpents, certain species attaining a length of thirty or forty feet, and being capable of swallowing Dogs, Stags, and even Cattle, at least according to some narrators, after having crushed them within their folds, lubricated them with their saliva, and enormously dilated their jaws and gullet. This operation lasts a long while. A remarkable particular of their anatomy consists in their having one lung but half shorter than the other. [At the extremity of the great lung in all this tribe is an extremely capacious air-bag, the use of which appears to be for containing the air requisite for respiration, when the nostrils are closed by the tedious process of deglutition.] We subdivide these Serpents according to the teguments of the head and jaws.

Some have the head covered as far as the tip of the muzzle with small scales resembling those of the body, and the plates which invest the jaws are not furrowed with grooves. Others have scaly plates beneath the eyes as far as the muzzle, and no furrows to the jaws. Some, again, have scaly plates upon the muzzle, and grooves upon those of the sides of the jaws. There are some with plates on the muzzle, and the sides of the jaw hollowed into a slit-like chink beneath the eye and further backward. And, lastly, some have no furrows, and the muzzle invested with plates but slightly prominent, which are obliquely cut backwards in front and truncated at the tip, so as to terminate in corners : these have the body much compressed, and the back keeled. They inhabit the East Indies whereas the others are from America, and should form a distinct subgenus—*Cenchris*, Gray.

#### THE SCYTALS (*Pseudoboa*, Schneider).

Plates, not only on the muzzle, but over the cranium, as in the Snakes proper ; no grooves, the body round, and head even with the trunk, as in the Roles.

Daudin has likewise separated

#### THE ERYX,—

Which differ by having a very short obtuse tail, and by their ventral plates being narrower. The head is short and nearly even with the body, characters in which they approximate the Roles, were it not that the conformation of their jaws permitted these to distend. The head is covered with small scales ; and they have also no hooks near the anus.

#### THE ERPETONS, Lacepede,—

Are very remarkable for having two soft prominences covered with scales, at the tip of the muzzle ; head plated ; the plates of the belly not very wide, and those of the under-part of the tail different from the other scales. Their tail, however, is long and pointed.

#### THE SNAKES PROPER (*Cotuber*, Lin.)—

Comprehended all the species, venomous or non-venomous, the plates underneath the tail of which are divided each into two, or, in other words, ranged in pairs.

Independently of the subtraction of the venomous kinds, their number is so vast that we are obliged to have recourse to all sorts of characters in order to distinguish them. First, are separated

#### THE PYTHONS, Daudin,—

Which have hooks near the anus, and narrow ventral plates, as in the Boas, from which they only differ by having the plates underneath the tail double. Their head is plated at the tip of the muzzle, and their lips grooved. Species occur as large as any Boa.

Some of these Pythones have the first, and others the terminal plates of their tail, simple ; but these are perhaps accidental varieties.

The *Cerberi*, like the true Pythones, have the head entirely covered with small scales, with the exception of plates between and before the eyes ; but they have no hooks near the anus. They have sometimes also simple plates at the base of the tail.

*Xenopeltis*, Reinwardt ; have great imbricated triangular plates before the eyes, which might be confounded with the scales adjacent to them, only that the latter are smaller.

*Heterodon*, Beauvois.—The ordinary plates of this group, but the tip of the muzzle composed of a short single piece, in form a trihedral pyramid, which is a little raised and erected above, a conformation which has induced the appellation of pig-snouted Serpents.

The *Hurria*, Daud.—Indian species, with subcaudal plates always simple, except those at the point, which are double ; these trivial anomalies, however, merit but little notice.

The *Dipsas* of Laurenti (*Bungarus*, Oppel).—Body compressed, and very much larger than the head : the range of scales along the spine of the back larger than the others.

*Dendrophis*, Fitzinger ; *Ahatulla*, Gray.—Resemble the last by having a range of broader scales along the back, and narrower scales along the flanks ; but their head is not wider than the body, which is slender and very much lengthened. Muzzle obtuse.

*Dryinus*, Merrem; *Passerita*, Gray.—Body as long and slender as in the last, but a small and slender pointed appendage at the tip of the muzzle.

*Dryophis*, Fitzinger.—The same long filiform or cord-like body, but no appendage, and the scales of equal size.

*Oligodon*, Boié. Small species, with an obtuse, short, and narrow head, and no palatal teeth.

After all these dismemberments by different authors, there yet remain several which appear to me less worthy of adoption; being founded on slight differences in the proportions of the head, the thickness of the trunk, &c.: and there is still left a group the most numerous of all in species, that of

The Snakes, as most restricted, which have no peculiar distinguishing character. Several of these are found in France, [and one only in Britain, the common Ring-necked Snake (*C. natrix* and *Natrix torquatus*), which attains to a yard in length, and feeds on Frogs, Mice, insects, &c.] It is eaten in some provinces of France. The exotic species are innumerable: some are remarkable for the splendour of their colours; others for the regularity of the distribution of them; many are quite uniform in their tints; and a few only attain a very large size.

#### THE ACROCHORDUS, Hornstedt—

Are readily distinguished from the rest of this family by the uniformly small scales with which their body is covered both above and below.

The known species (*A. javensis*, Lac.; *Anguis granulatus*, Schneider,) has each of its scales raised into three little crests, resembling, when the skin is very loose, three isolated tubercles. It grows to a large size. Hornstedt has stated that it subsists altogether on fruits, which in an animal of this kind would be very extraordinary.

The Venomous Serpents *par excellence*, that have isolated fangs, present a peculiar structure of the organs of manducation.

Their superior maxillary bones are very small, borne upon a long pedicle, analogous to the outer pterygoid apophysis of the sphenoid, and are also very moveable; having a pointed tooth affixed to them, which is pierced by a small canal, through which issues a liquid secreted by a large gland beneath the eye. This liquid it is, instilled into the wound inflicted by the tooth, which poisons the bodies of animals, and produces effects more or less deadly, according to the species from which it is derived. The tooth lies down flat in a fold of the gum when the Serpent has no occasion for it, and behind it are several germs designed successively to replace it, in case it should be left in a wound. Naturalists have termed these venomous teeth *crochets mobiles* [or *fangs*], but it is properly the maxillary bone that moves. These Serpents have no other teeth besides the double range upon the palate.

All the venomous species of which we possess certain information, bring forth their young alive, the eggs hatching within the body of the parent, [though during the act of parturition]. It is thus that their general name of *Vipers* has arisen, which is a contraction of *viviparous*.

Venomous Serpents with isolated fangs, present nearly the same external characters as the preceding; but the greater number have extremely dilatable jaws, and the tongue very extensile. Their head, which is wide posteriorly, has in general a savage aspect, which to a certain extent announces their ferocity. They form two principal great genera, the Rattle-snakes and the Vipers, of which the second has many subdivisions, around which some-alien small ones require to be grouped.

#### THE RATTLE-SNAKES (*Crotalus*, Lin.)—

Are more celebrated than any other Serpents for the deadliness of their venom. In common with the Boa, they have simple transverse plates beneath the body and tail, but are most obviously distinguished by the rattling instrument which they carry at the tip of the tail, and which is formed of several scaly cornets loosely attached together, that move and rattle whenever the animal shakes or alters the position of its tail. It appears that the number of these cornets increases with age, and that they acquire an additional one at each casting of the skin. Their muzzle is hollowed by a little rounded depression behind each nostril. All the known species are from America. They are so much the more dangerous, as the season or climate is hotter; but their ordinary habits are tranquil and sluggish. They move slowly, and only bite when provoked, or for the purpose of killing their prey. Although they do not climb trees, they nevertheless feed principally upon Birds, Squirrels, &c., which it was long believed they possessed the faculty of hallucinating or charming, so as to draw them by degrees to enter their throat. It would seem, however, that the fear which their appearance inspires occasions those disordered movements of their prey, which have given rise to the foregoing supposition.

Most of the species have the head scaled similarly to the back; while others have great plates upon the head. We approximate

The *Trigonocephali* of Oppel (*Bothrops*, Spix; *Cophias*, Merrem); which are distinguished by the absence of the rattle, but accord in their other characters. Some of these have simple subcaudal plates, as in the preceding,



and the head plated to the eyes; the tail terminated by a spur. Others have no subcaudal plates, and the head scaled like the back. Some have the head plated, with double subcaudal plates: and others conjoin to the latter character, excepting that the extremity of the tail has small scales both above and below, little scales upon the head also.

#### THE VIPERS (*Vipera*, Daud.).—

The greater number of which were confounded by Linnæus with the Snakes proper, on account of their double subcaudal plates, require to be separated from the latter by reason of their venomous fangs, and grade into other Serpents with single or partly double subcaudal plates, being distinguished from the Rattlesnakes and Trionocephalets by the absence of cavities beneath their nostrils.

Some have only keeled and imbricated scales upon the head, like those of the back; and others have the head covered with small granulated scales, [among which is the Viper or Adder of this country]. Some again [the *Cerastes*] have a pointed bone over each eyebrow, [and are peculiar to Africa]. Others, which are similar in all other respects to the preceding generally, have three plates a little larger than the scales which surround them upon the middle of the head. There are some Vipers, also, with plates upon the head, like those of the Common Snake.

*Naja*.—Are Vipers with plated heads, the anterior ribs of which can be dilated and thrown forward, so as to distend this part of the trunk into a disc more or less broad. The most celebrated species is the Cobra di Capella of India, with a spectacle-like mark on the disk, and which is extremely venomous. The Haje, or Asp, of Egypt, is another.

*Elaps*.—Head plated, and an opposite organization of the body to the Asps; their jaws even can scarcely widen, on account of the shortness of the tympanic bones, and especially of the mastoids, from which it results that the head is nearly of even size with the body, as in the Roles and Amphibænes.

*Micurus*, Wagner, has merely the tail shorter.

*Platurus*, Latreille.—Head also plated, and double plates beneath the tail; but the latter compressed like an oar, which renders them aquatic.

Finally, we place at the termination of the Vipers certain species which only differ in having single subcaudal plates, either partly or throughout. They are distinguished from the Tisiphones by having no cavities behind the nostrils.

Some, with entire plates at the base of the tail, compose the *Trimererurus*, Lacepede, having large plates on the head, and some of the subcaudal ones double, others single.

*Ophiocephalus*, Cuv.—Have great plates on the head, and all the subcaudals single.

*Acanthophis*, Daud.; *Ophrias*, Merrem.—Plates in front of the skull and of the head, the tail terminated by a hook, and all its plates simple, though sometimes there are double ones at its extremity.

*Echis*, Merrem.—Small plates on the head, and all the subcaudals single.

*Langaha*, Bruguières.—Head plated; the muzzle pointed and projecting; anterior half of the tail encircled with entire rings, and the posterior with little imbricated scales both above and below.

Besides these two tribes of Serpents properly so called, which have been longer known, a third has been discovered more recently, the jaws of which are organized and armed nearly as in the non-venomous kinds, but which have, nevertheless, the first of their maxillary teeth longer than the rest, and pierced for the purpose of conducting venom, as in the genera with isolated fangs, already described.

These Serpents form two genera, distinguished from those of the two allied families, by the scaling of the belly and under-part of the tail.

#### THE BONGARS (*Pseudoboa*, Opper).—

Possess, like the Boas, the Rattlesnakes, and the Scytals, simple plates beneath the belly and tail. Their head is short, covered with large plates, and the occiput but slightly bulged. Their most characteristic distinction, however, consists in their very carinated back being furnished with a longitudinal range of scales, broader than the lateral ones, as in the Dipsas.

They inhabit the East Indies, where they are called *Rock Snakes*, one of the species attaining a length of seven or eight feet.

#### THE HYDRAS (*Hydrus*, Schneider, in part; *Hydrophis* and *Pelamides*, Daud.).—

Have the back part of the body and tail very much compressed and raised vertically, which, imparting to them the power of swimming, renders them aquatic animals. They are very common in certain parts of the Indian Seas, [and excessively venomous, feeding on fishes]. Linnæus ranged those that were known to him among the Orevets, on account of the small scales with which they are wholly covered. Daudin has subdivided them as follows:—

*Hydrophis*.—These have a range of scales a little broader than the rest under the belly, as in the Erpetons and Roles; the head small, not bulged, obtuse, and covered with large plates. Several species are found in the salt water of Bengal, and others in the Indian ocean.

*Pelamides*.—have, also, great plates on the head, but their occiput is bulged on account of the length of the

pedicles of their lower jaw, which is extremely dilatable; all their body-scales are equal, of small size, and disposed hexagonally. To these subgenera I have added that of

*Chereydrus*,—the head and body of which are equally covered with small scales.

### THE THIRD FAMILY OF OPHIDIANS,—

#### THE NAKED SERPENTS,—

Comprises but one very singular genus, which several naturalists have deemed to belong rather to the Batrachians, although we are not aware that it undergoes any metamorphosis. It is that of

#### THE CÆCILIANS (*Cæcilia*, Lin.),—

So named on account of their excessively minute eyes, which are nearly hidden by the skin, and are sometimes absent altogether. The skin is smooth, viscous, and annularly wrinkled, appearing naked, although, upon dissection, some perfect though minute scales are discernible, which are regularly disposed in several transverse ranges between the wrinkles of the skin, and which we have detected, with certainty, in more than two species. The head is flattened, the anus round and nearly at the extremity of the body, the ribs much too short to encircle the trunk, the articulations of the vertebræ together are by conically hollow facets filled up with gelatinous cartilage, the same as in the Fishes and some of the lower Batrachians, and, in a slight degree, in the Amphibians only, among the other Ophidians; their maxillary bones cover the orbits, which are pierced by only a very small foramen, and the temporal bones extend over the fossa, so that the skull presents a continuous bony buckler above; their hyoid bone, composed of three pairs of arcs, induces the supposition that it originally supported gills. The maxillary and palate teeth are arranged in two concentric lines, the same as in the Protocæns, but are often sharp and curved backward, as in the Snakes properly so called; the nostrils open behind the palate, and the lower jaw has no moveable pedicle, the tympanic bone being encased, together with the other bones, in the buckler formed by the skull.

The auricle of the heart of these animals is not divided so deeply as to be considered double, but their second lung is as small as in the other Serpents; the liver is divided into a great number of transverse laminae. In their intestines have been found vegetable matter, together with soil and sand. Their ear has merely a small plate upon the oral orifice, the same as in the Salamanders.

Some of them have an obtuse muzzle, lax skin, very deep wrinkles, and two small cilia near the nostrils; as *C. annulata* of Brazil, which is found in marshy places several feet under ground, *C. glutinosa* of Ceylon, &c.; while others have the folds of the skin nearly obsolete, a very long slender body, and projecting muzzle. One of these is totally blind, the *C. lumbricoides*, Daudin; it is of a blackish colour, two feet long, and no thicker than a goose-quill.

### THE FOURTH ORDER OF REPTILES,—

#### THE BATRACHIANS,—

Have but one auricle and one ventricle to the heart, [an assertion disproved by Professor Owen]. Their two lungs are always equal, and when young they conjoin to these, gills, which give them a relationship with the class of Fishes, and which are borne on the sides of the neck, upon the cartilaginous arches which support the hyoid bone. The greater number lose these gills, together with the supporting apparatus of them, upon attaining the perfect state: three genera only, the Syrens, Protei, and Menobranchi, retaining them at all ages.

During the period of the retention of the gills, the aorta, on proceeding from the heart, divides into a number of branches upon each side, corresponding to that of the gills; the blood from the gills returning through veins which unite together towards the back, into a single arterial trunk, as in Fishes: this trunk, or the veins which form it more directly, supplies the greater number of arteries which nourish the body, and even the vessels which conduct the blood for respiration into the lungs. But in the species which shed their gills, the vascular ramifications that communicate with them become obliterated, excepting two, which unite together to form a dorsal artery, each giving off a small branch to the lung of its particular side, so that the circulation of a Fish becomes thus converted into that of a Reptile.

These animals have neither scales nor carapace, but the body is invested with a naked [and moist] skin, [over the surface of which the blood receives much of its oxygenation.] With the exception of one genus, they have no nails to the toes.

The envelope of their eggs is simply membranous, and in most cases these are fecundated as they issue forth, the male attaching himself to the other sex in order to be simultaneous.

Their eggs or spawn enlarge very much in the water after they have been laid. The young not only differs from the adult by the presence of its gills, but its feet are only developed by degrees, and in several genera there are also a deciduous beak and tail, and intestines of a different form. Some of the species are even viviparous.

#### THE FROGS (*Rana*, Lin.)—

Have four legs and no tail in their adult state. Their head is flat, the muzzle rounded, the mouth deeply cleft, and the greater number have a soft tongue attached only to the lower part of the gullet, but which extends forward to the jaw, and is doubled back above. Their fore-feet have only four toes, but the hinder sometimes show the rudiment of a sixth.

Their skeleton is entirely deprived of ribs. A cartilaginous plate, even with the head, takes the place of tympanum, and renders the ear visible externally. The eye has two fleshy lids, and a third, which is horizontal and transparent, concealed by the lower one.

The inspiration of air is produced simply by the movements of the muscles of the throat, which, by dilating, draw in the air through the nostrils, and, by contracting, whilst the orifices of the nostrils are closed by means of the tongue, force the air into the lungs. Expiration, on the contrary, is effected by the contraction of the muscles of the lower belly: so that, by opening the belly of the living animal, the lungs will distend without any power of contraction, and by holding open the mouth the animal will become asphyxiated, for want of air sent into the lungs.

The embraces of the male are excessively prolonged: in reference to which the thumb of this sex is furnished with a spongy swelling, which enlarges during the season, and which is designed to aid in grasping. The eggs are fecundated at the moment they are laid, and the young is termed a *tadpole*. It is at first provided with a long fleshy tail, and a small horny beak, but with no other apparent members besides certain little fringes at the sides of the neck. These disappear after some days, but Swammerdam assures us that they still exist as gills underneath the skin. The latter are minute crests, which are very numerous, attached to the four cartilaginous arches placed on each side of the neck adhering to the hyoid bone, and enveloped by a membranous tunic, which is covered by the general skin. The water, entering by the mouth, to bathe the intervals of these cartilaginous arches, passes out either by two orifices or by a single one, according to the species, pierced through the external skin, either on the middle or on the left side of the animal. The hind feet are gradually developed to view, by little and little, while the anterior likewise appear beneath the skin, but do not burst it for some time later. The tail is absorbed by degrees. The beak falls, and occasions the genuine mandibles to appear, which had previously been soft, and were concealed underneath the skin. The gills shrink and are obliterated, leaving the lungs to perform their functions unassisted by them. The eye, which in the Tadpole was only visible through a thinner space in the skin, becomes apparent with its three lids. The intestines, previously very long, slender, and spirally contorted, shorten, and acquire the enlargement of stomach and colon: the Tadpole living solely upon aquatic vegetation, whilst the adult animal preys on insects and other animal substances. Finally, the limbs of the Tadpole reproduce the parts of them that had been mutilated, nearly as in the Newts.

The particular epoch of each of these several changes varies, according to the species.

In temperate and cold climates, the perfect animal buries itself, during winter, under ground, or in the mud below the surface of water, where it continues to live without food or respiration, [beyond what of the latter is effected by the surface of the skin]; although, during the warm season, if it be held for a few minutes only with the mouth open, so as to impede the process of respiration, it perishes.

#### THE FROGS, properly so called, (*Rana*, Laurenti),—

Have a slender body, and the hind limbs very long, and more or less palmed; their skin is smooth and slippery; their upper jaw supplied all round with a range of minutely fine teeth, and they have an

interrupted range across the middle of the palate. The males have, on each side, under the ear, a delicate membrane, which is inflated with air when they croak. These animals both swim and leap with celerity.

[One only (*B. temporaria*) is indigenous to the British Isles.]

*Ceratophrys*, Boié,—are Frogs with a broad head, the skin wholly or partly granulated, and a horn-like membranous prominence over each eyelid.

*Dactylethra*,—South African species, with pointed toes, those of the hind-feet broadly palmated, and the three internal having their extremities enveloped by a conical nail, of a black horny substance.

*Hyla*, the Tree-Frogs,—differ in no respect from the common ones, excepting that the extremity of each of their toes is widened and rounded into a sort of viscus palette, which enables them to adhere to the surfaces of bodies, and to climb trees, to which last they resort, during the summer, in pursuit of insects; but they deposit their eggs in water, and penetrate into the mud in winter, like other Frogs. Several species are decked in the gayest colours.

#### THE TOADS (*Bufo*, Laurenti).—

Have the body thick and squat, and covered with tubercles, with a large swelling pierced with pores behind each eye, from which a fetid milky secretion is expressed; no teeth whatever; and the hind limbs but little elongated. They leap badly, and are generally found at a distance from water. They are animals of hideous, disgusting form, the saliva of which has been erroneously considered venomous, as also their teeth, their supposed urine, and even the moisture which exudes from the skin; [the latter being, in fact, absorbed by the skin, for the purpose of cutaneous respiration, often in great quantity, so that the animal, when seized and taken up, lightens itself by discharging a quantity of this from the anus.]

[Two species are found in Britain, viz., the Common Toad (*B. vulgaris*), which progresses more by leaping than crawling; and the Natterjack (*B. calamita*), an inhabitant of heaths and commons in the south of England, which has a yellow mesial stripe along the back, never leaps, but creeps with considerable celerity, and utters a chirping cry. Its appearance is less unprepossessing than that of the other.]

*Bombinator*, Merrem,—only differs from *Bufo* by having the tympanum concealed beneath the skin.

*Rhinella*, Fitzinger; *Oxyrhynchus*, Spix,—has the muzzle pointed anteriorly.

*Atlophus*, Cuv.—Muzzle angular, and a crest on each side of the head, extending round the parotid. ●

*Breviceps*, Merrem; *Engystoma*, Fitzinger, in part.—No tympanum nor parotid visible externally, an oval body, the head and mouth very small, and feet but slightly palmated.

*Pipa*, Laur.—The body horizontally flattened; head large and triangular; tongue wholly wanting; tympanum concealed beneath the skin; small eyes placed towards the margin of the upper jaw; each of the front toes split at the tip into four little points; lastly, an enormous larynx in the male, formed as a triangular bony box, within which are two moveable bones which can close the entrance of the bronchi.

The longest known species (*R. pipa*, Lin.) inhabits the obscure nooks of houses in Cayenne and Surinam, and has a granulated back, with three longitudinal ranges of larger granules. The male places the eggs of the female upon her back, where they are fecundated, upon which the female returns to the water, the skin of her back swelling so as to form a number of cells, which inclose each of the eggs, and wherein the young pass their tadpole state, until they have lost their tails, and developed their limbs, at which time the mother returns to land.

#### THE SALAMANDERS (*Salamander*, Brong).—

Have an elongated body, four limbs, and a long tail, which give them the general form of Lizards, whence Linnæus left them in that genus; but they have all the characters of Batrachians. Their head is flattened; the ear concealed entirely by the flesh, having no tympanum, but merely a little cartilaginous plate over the *fenestrum ovale*; both jaws furnished with numerous minute teeth; two longitudinal ranges of equal teeth on the palate, but attached to the bones that represent the vomer; tongue as in the Frogs, no third eyelid; a skeleton with three small rudiments of ribs, but no bony sternum; a pelvis suspended by ligaments to the spine; four toes before, and nearly always five behind. They respire, in the adult state, in the same manner as the Frogs and Tortoises. Their tadpoles breathe at first by gills in the form of crests, to the number of three on each side of the neck, which are subsequently obliterated, and which are suspended to cartilaginous arches, that form portions of the hyoid bone of the adult. A membranous operculum covers these apertures; but the gill-crests are never inclosed within a tunic, but float loosely. Their fore-feet are developed before the hind, and the toes appear successively. ●

The terrestrial species (*Salamandra*, Laurenti) have, in the perfect state, a round tail, and only remain in the water during their state of Tadpole, which endures but for a brief period, and when they resort to that element to breed. Their eggs are inclosed in an oviduct. Those of Europe have, on each side of the occiput, a gland analogous to that of the Toads.

The Aquatic Salamanders (*Triton*, Laurenti) permanently retain the vertically-compressed tail, and pass nearly their whole lives in the water. [It is certain, however, that those of Britain all leave the water at the end of summer, and have then a round tail. The small ones, even with the remnants of their gills still attached, may be

found in abundance at that period about the roots of rushes, &c., in the vicinity of ponds; whence it is not true that they quit in consequence of the water being dried up, as has been suggested].

The experiments of Spallanzani, on the extraordinary power which these animals have of reproducing their parts, have rendered them celebrated. They renew, many times successively, the same member after it had been severed; and this with all its bones, muscles, vessels, &c. Another faculty, not less singular, consists (as shown by Dufoy) in their recovering after having been long frozen up in ice. Their eggs are fecundated by fluid dispersed in the watery medium, which penetrates with the water into their oviducts. They lay long chaplets of eggs, and the young appear fifteen days from the deposition of them, retaining their gills for a longer or shorter period according to the species. Modern observers have distinguished several European species, the males of which develop high membranous dorsal crests very early in the spring, [which are absorbed, and the remnants cast off, ere they leave the water at the end of summer. One, with a smooth olive-coloured skin like a Frog (*T. punctatus*), and handsomely spotted with black, is common in stagnant waters throughout Britain; and two others (*T. palustris* and *T. marmoratus*), with a granulated skin like a Toad, and also spotted upon a much darker ground, and punctated with white, are—the first at least—equally so. All have the under parts bright orange colour. Those with granulated skins resemble the Toads in the capability of remaining without food for a most extraordinary period, in a state of imprisonment, having been found occasionally in closed cavities, where they must have remained for many years.]

The skeleton of an animal of this genus has been found among the schists of Æningen, which is three feet in length. It is the pretended fossil man of Scheuchzer.

In the suite of the Salamanders should range several very similar animals, some of which are reputed never to have gills, while others, on the contrary, retain them permanently, notwithstanding which they have the same lungs as the other Batrachians, being thus the only vertebrated animals that are truly amphibious.

The former of these, which have never been seen with gills, fall under two genera.

#### THE MENOPOMA, Harlan.

Form altogether that of a Salamander, the eyes apparent, feet well developed, and an orifice on each side of the neck. Besides a range of fine teeth surrounding the jaws, they have a parallel range before the palate. The known species, fifteen to eighteen inches in length, inhabits North America, where it is termed *Hell-bender*.

#### THE AMPHIUMA, Garden,—

Has also an orifice on each side of the neck, but the body is excessively elongated; the limbs and feet, on the contrary, but little developed; and the palatal teeth form two longitudinal ranges. Likewise from North America.

Among those which permanently retain their gills,

#### THE AXOLOTLIS,—

Altogether resemble the tadpole of a Salamander. They have velvety teeth to both jaws, and two bands of the same upon the palate. From Mexico.

#### THE MENOBRANCHUS, Harlan,—

Has but four toes to each foot; a range of teeth on the intermaxillaries, and another parallel but more extended range, on the maxillaries.

#### THE PROTEUS, Laurenti.

Three toes before, and only two behind; the muzzle lengthened and depressed; both jaws furnished with teeth; tongue but slightly moveable, and free anteriorly; eyes excessively small, and couched beneath the skin, as in the mammiferous genus *Spalax*; ear covered by the flesh, as in the Salamanders; and skin smooth and whitish. The skeleton resembles that of the Salamander, except that it has many more vertebrae, and fewer rudiments of ribs; but the general conformation of the skull is very different. Inhabits the subterranean waters, with which certain lakes in Carniola communicate.

#### THE SYRENS (*Syren*, Lin.)—

Are elongated animals, having nearly the form of Eels, and three branchial crests; no hind feet, nor even vestige of pelvis; head flattened; mouth not deeply cleft; muzzle obtuse; eye very small; ear concealed; lower jaw armed with teeth all round, but none in the upper; and two raised series on each side of the palate.

One species (*S. lacertina*, Lin.) attains a length of three feet. Others are smaller, with the branchial crests less developed, and compose the *Pseudobranchius* of Gray.

## THE FOURTH CLASS OF VERTEBRATED ANIMALS.

### THE FISHES—(PISCES).

[Fishes are the proper vertebrated inhabitants of the waters; and they are formed and organized for living, moving, and in general finding their food, wholly within this element. The nature of their locality necessarily makes their history obscure, because human observation extends to only a very limited portion of the waters, and in that portion to only a trifling depth; but when we consider that, exclusive of lakes and rivers, the seas occupy full seven-tenths of the earth's surface, that those seas yield food as far down as the rays of the sun can extend their life-giving energy, and that there is no obstacle in the water to bar the motions of the fish, we can at once see that, of all vertebrated animals, they must be the most numerous, and probably they exceed in numbers the whole of the other three classes of the same grand division of animated nature. They inhabit, stratum super stratum, as it were,—one species near the surface, another near the bottom, and others, again, range through the intermediate depth. What may be the absolute depth of the ocean waters at which life ceases, and the profound of death and darkness begins, we have no direct means of ascertaining. It varies, of course, with the latitude, being greater as the rays of the sun are more direct, and less as their obliquity increases; and it probably also varies with the nature of the bottom. In correspondence with the vast range of pasture which is assigned to the Fishes, their productive powers are enormous,—the young produced by one Cod-fish, at a single deposit, being ascertained to be not much less than four millions, while in the common Flounder they are not fewer than one hundred and fifty thousand. A fertility so enormous, as compared with anything we are acquainted with on land, of itself shows the importance of the Class, and how well they are adapted for supplying each other with food. But, interesting as it is, the space to which we are restricted, forbids any disquisition on their physiology; and all that we can accomplish, is to render the text of the last edition of Cuvier's great work, as faithfully in substance, and as briefly in expression, as we possibly can. Our own original remarks must necessarily be few; and we shall inclose them in brackets, the same as this introductory paragraph, to distinguish them from the substantive part of the genuine text of Cuvier, which, in the way of systematic arrangement, has received no improvement, since the science of Zoology was deprived of that foremost of its cultivators.]

Fishes are oviparous Vertebrata, with a double circulation, and respiring through the medium of water. For this purpose they have, on each side of the neck, branchiæ, or gills, consisting of arches of bone attached to the *os hyoides*, or bone of the tongue; and to these arches the filaments of the gills are attached, generally in a row upon each, and having their surfaces covered by a tissue of innumerable blood-vessels. The water taken in by the mouth passes through among the filaments of the gills, and escapes by the gill-openings towards the rear. In its progress through the filaments of the gills, the water imparts to these the oxygen of the air which it contains [and receives carbon in return, the same as in the lungs of an air-breathing animal. The gills of a fish do not decompose water, so as to derive oxygen from it, but merely sepa-

rate the oxygen from the atmospheric air contained in the water; and hence, if water is deprived of this air, or impregnated with deleterious gases, Fishes cannot live in it. As little can they bear the return of water entering at the gill-openings, and escaping by the mouth; for if a fish is held so that the water is made to pass in this direction, it is as speedily drowned as if it were an air-breathing animal]. The blood is brought to the gills by the heart, which thus answers to the right ventricle of warm-blooded animals; and from the gills it is sent to an arterial trunk, lying immediately upon the under side of the back bone, which trunk is the left or systematic ventricle of the heart, and sends the blood throughout the body of the fish.

Living habitually in water, which is of very nearly the same specific gravity as their bodies, Fishes have no weight to bear, but merely to propel themselves through the water; and their form and their organs of motion are all adapted to this one purpose, though varying in the species. In many, there is under the spine a membranous air-bladder, which the fish can expand or contract at pleasure; and this is understood to alter its gravity, and enable it to suspend itself at any depth in the water. [Many fishes, wanting this apparatus, have, however, nearly the same habits as others which are possessed of it.]

Progressive motion is effected by the tail striking alternately right and left against the water, [for which purpose the flexure of the spine is lateral, whereas in the other Vertebrata generally, the principal flexure is vertical], and perhaps the jet of water thrown backward from the gill-openings may assist. Thus a fish has but little use for extremities; and the parts analogous to legs and arms are accordingly very short, terminating in a number of rays analogous to fingers and toes, and these, covered by membranes, form what are termed fins. The fins answering to arms are called *pectorals*, and those answering to legs *ventrals*; and besides these there are often fins on the back called *dorsal*, behind the vent called *anal*, and on the extremity of the tail called *caudal*.

The texture of the fins is important in classification. If the rays consist of single bones, whether stiff or flexible, they are said to be *spinous*; and if they consist of a number of jointed pieces, divided at their extremities, they are called *soft*, or *articulated*.

The pectorals are attached to two bones immediately behind the gills, and answering to the *scapulars*, which bones are sometimes imbedded in the muscles, or attached to the spine, but generally to the bones of the head. The *pelvis* rarely adheres to the spine; and it is often in advance of the belly, and attached to the bones of the shoulders.

The *vertebræ* have their proximate surfaces concave, and filled with cartilage, which forms the joints, and is generally continued by an aperture through the centre of each *vertebra*. Spinous processes, upwards and downwards, support the muscles, and maintain the vertical position of the body; but, as far as the cavity extends, the downward processes are wanting, and there are transverse processes, to which the ribs are sometimes soldered by cartilages.

The head varies much in form, but in general consists of the same number of bones as in the other Vertebrata,—a frontal of six pieces, parietals of three, occipitals of five, and five of sphenoid and two of each temporal bone, are included in the composition of the cranium.

Besides the brain, which is disposed as in Reptiles, Fishes have nodes or ganglions at the base of their olfactory nerves. The nostrils are simple cavities at the end of the muzzle, always pierced with two holes, and lined by a regularly-plaited pituitary mem-

brane. In their eyes, the cornea is flat, and there is a little aqueous humour, but the crystalline lens is almost spherical, and very hard. The ear is a sac, in which are suspended small hard bodies; and there are three membranous canals within the cranium in ordinary fishes, but in its walls in the cartilaginous ones. They want the Eustachian tube and tympanal bones; and only the Sharks and Rays have an external opening, which in them is level with the head. As great part of the tongue is bony, and as it is often furnished with teeth and other hard parts, Fishes can have little sense of taste. The fleshy *cirri*, or beards as they are termed, of some of the species, are perhaps organs of touch. The body is in general covered with scales, and generally speaking they have no organ of prehension except the mouth.

In most fishes, the intermaxillary bone forms the edge of the upper jaw, having the maxillary or the labial behind it. The palatal bones, pterogoid and zygomatic processes, and the tympanum and squamosa, form an anterior jaw, as in Birds and Serpents, to the posterior part of which the lower jaw is articulated, which jaw has generally two bones in each side, except in the cartilaginous fishes. The teeth are very various in situation, in number, and in form. They are found on the intermaxillaries, the maxillaries, the lower jaw, the vomer, the palate, the tongue, the gill-arches, and even on the bones of the pharynx behind these; [but many fishes have them only on some of these places, and there are some which are almost, if not altogether, toothless].

Besides the gill-arches, the hyoid bone supports the gill-membrane. The *gill-lids*, or *operculi* [by the working of which respiration is carried on], consist of three pieces, the operculum, sub-operculum, and inter-operculum. These are articulated on the temporal bone, and play on the pre-operculum; but many of the cartilaginous species want them.

The stomach and intestines differ greatly; and, except in cartilaginous fishes, the pancreas is supplied by cœca round the pylorus, or by a duplicature of the intestine. The kidneys are against the spine, but the bladder is above the rectum, and opens behind the vent and the reproductive passage, contrary to what is found in the Mammalia. The male organs are large glands termed *milts*, and the female are sacs, which also attain great size, and have the eggs in their internal folds. In most fishes, there is no impregnation till after the expulsion of the eggs; but in the Sharks and Rays, and some others, the case is different, some of them producing perfect eggs, and others bringing forth the young alive.

The proper classification of Fishes is a very difficult matter. There are two distinct series of them:—FISHES, properly so called, or *Bony Fishes*; and *Cartilaginous Fishes*, or CHONDROPTERYGII. The latter want some bones of the jaws, and have other peculiarities: they are divided into three orders;—

CYCLOSTOMI (round-mouths, or suckers), which have the jaws soldered into a sort of ring, and numerous gill-openings.

SELACHII (Sharks and Rays), which have gill-openings similar to the former, but the jaws not soldered into a ring.

STURIONES (Sturgeons), which have the gill-openings with a lid, as in the Fishes properly so called.

Of the ORDINARY FISHES, or those with bones in the skeleton, one order have the maxillary bone and the palatal arch fixed to the cranium. These are called PLECTROGNATHI (soldered jaws), and they consist of two families: *Gymnodontes* (naked teeth), and *Sclerodermi* (hard skins). Another order, the LOPHOBRANCHII, which consists



but of one family; and which, with the jaws perfect, have the filaments of the gills arranged in tufts upon the arches.

In the rest, which include by much the greater number of the True Fishes, the character employed by Ray and Artedi, and taken from the nature of the first rays of the dorsal and anal fins, furnishes two principal divisions. These are *MALACOPTERYGII* (soft fins), in which all the rays, with the occasional exception of the first dorsal or the pectorals, are soft or jointed; and *ACANTHOPTERYGII* (spiny fins), in which the first portion of the dorsal, or first dorsal when there are two, always have spinous rays, and which have also some in the anal, and at least one in each ventral.

The first of these sub-classes may be divided according to the position of the ventral fins. If these are on the belly, the fishes are *Abdominal*; if attached to the shoulder, they are *Sub-brachian*; and if wanting, they are *Apodal*. Each of these orders comprises certain families, of which the abdominal ones are very numerous.

The Spinous Fishes do not admit of this kind of division; but must be separated into families, the characters of which are, in many instances, well defined. The same gradation of families cannot be traced among Fishes as among Mammalia. Thus, the organs of sense, and those of generation in some, indicate connexion between Cartilaginous Fishes and Serpents, while the imperfect skeleton of others of these fishes indicates a relation to Mollusca and Worms, [though the far more important disposition of the nervous system, characteristic of the type of Vertebrated Animals, is still retained.

The abstract of Cuvier's arrangement of Fishes, by far the best—that is, the most natural, which has hitherto been made, or which there are materials for making—may be given briefly thus:—The series of True or Bony Fishes he divides into the two divisions already mentioned, as distinguished by the rays of the fins. The Spinous Fishes form a single order, and this order he divides into fifteen families, which he names, from some well-known species as the type, or for some marked peculiarity of character which belongs to the whole of the family and to no other fish. The Soft-finned Fishes he divides into three orders, according as the ventral fins are abdominal, thoracic, or wanting; and the Cartilaginous Fishes he divides into two orders,—those with free gills, and those with the gills fixed.]

## THE FIRST ORDER OF BONY FISHES.

### ACANTHOPTERYGII.

This first order contains by far the greater number of the Ordinary Fishes. Their characters are spinous rays in the first dorsal, if there are more than one, and spinous rays in the first part if there is one only; but sometimes, instead of a first dorsal, they have free spines without any connecting membranes. The anal fin has also its first rays spinous; and there is generally one such ray in each ventral. [When we speak of the first ray of a fin, we mean the one nearest the head of the fish, which is easily understood in the other fins, and is the extreme one either above or below in the caudal.]

The spinous fishes are arranged into fifteen families, and some of these families contain a vast number of genera. The families are named, as already noticed, from some well-known species, or some strikingly peculiar character. [When a species is the type, the technical name of the family ends in *idæ* or *oidæ*, the Greek word for resemblance; and when it is founded on a peculiar character, the name is descriptive of that].

## THE FIRST FAMILY OF THE ACANTHOPTERYGII.

## PERCIDÆ (the PERCH Family).

These fishes have the body oblong, covered with hard or rough scales, with the gill-lid or gill-flap, or often both, toothed or spinous in the margins. The species are very numerous in the waters of all warm countries; their flesh is in general agreeable and wholesome; they are mostly *thoracic*, or have the ventral fins under the pectoral, and they are subdivided according to the number of gill rays. The first division have seven rays in the gills, two dorsal fins, and all their teeth are *velvety*. [Cuvier makes use of this expression as descriptive of very minute teeth, set closely together in numerous rows, and thus resembling the pile of velvet in arrangement though not in texture.]

This division comprises various species, of which the following are the principal genera:—

*Perca*, including the Common Perch of Europe, and various other species of North America and other places; *Labrax*, the *Basse*, a marine genus, of which species are found both in Europe and in America; *Lates*, the Perch of the Nile, of which there are also species in the Indian rivers; *Centropomus*, the Sea Pike, which has the operculum obtuse and without spines; *Grammistis*, an Indian genus, with white longitudinal stripes, and a black ground; *Arpo*, the River Perch, found chiefly in the Rhine; *Zingel*, a peculiar Perch of the Danube, with thirteen spines in the first dorsal.

This subdivision also comprehends some fishes of foreign countries, whose peculiarities cause several subgenera. These are, *Huro*, like a true Perch, only the pre-operculum is not toothed; *Etelis*, with hooked teeth in the jaws, but not in the palate; *Nippon*, with strong spines on the pre-operculum and operculum; *Enoplosus*, like a Perch, but with body much compressed, two high dorsals, and the pre-operculum deeply toothed; *Diplorion*, compressed, double-toothed border to the pre-operculum, and two spines on the gill-lid. Other species of this subdivision are, *Apogon*, small fishes, of a red colour, with two dorsals far apart, and large scales, easily separated. One of them, the King of the Mullet, or Beardless Mullet, is found in the Mediterranean; *Cheilodipterus*, resembling the former, but with long teeth in the jaws; and *Pomatomus*, a very rare genus, of small size, with immense eyes, and exceedingly small teeth, velvety in their arrangement.

A second subdivision have two dorsal fins, but long and pointed teeth, mingled with a velvety arrangement.

Of these the principal genera are *Ambassis*, with the dorsals near each other, and a spine in front of the former; they are small fishes of the warm regions of the East, abundant in pools and rivulets, and sometimes prepared as Anchovies; and *Lucio-perca*, the Perch-Pike, with long teeth on the maxillaries, and also in the palate, found in Eastern Europe.

The second division of the Perches have seven rays in the gills, but only one dorsal fin; the genera are arranged by the characters of their teeth, and the leading ones are these:—

*Serranus*, the Sea Perch; *Anthias*, the Barber, a beautiful red fish of the Mediterranean, with metallic reflections; *Merous*, the Great Perch, and some varieties.

Distinct from these are several genera, *Plectropoma*, *Diacopus*, *Mesoprion*, *Acerina*, *Rypticus*, *Polypriion*, *Centropristis*, and *Gristes*. These inhabit different parts of the world, and some of them are beautiful fishes.

The Percidæ with less than seven gill-rays, are arranged according to the number of their dorsal fins and the characters of their teeth.

With a single dorsal, some have hooked teeth among the other ones, as *Cirrhitæ*, which inhabit the Indian Ocean, and have six gill-rays. Others have only small teeth, among which there are the following genera, *Chironemus*, *Pomotis*, *Centrarchus*, *Priacanthus*, *Dules*, *Therapon*, *Palates*, and *Elotes*. These are chiefly fishes of the warm countries, some of the fresh water and others of the sea; their colour is in general silvery, marked with blackish longitudinal lines.

There are two genera of Percidæ which have less than six gill-rays and two dorsals.

These genera are *Trichodon*, a native of the North Pacific; and *Sillago*, found in the Indian Ocean. One of the latter is supposed to be the finest fish in India.

We now pass on to other Percidæ, which have more than seven gill-rays, and seven soft rays besides a spine in their ventrals, the other *Acanthopterygii* having never more than five soft rays.

The genera, *Holocentrum*, *Myripristis*, *Beryx*, and *Trachichthys*, all of which are brilliant fishes of the warm seas, and some have the air-vessel divided into two parts.

All the Percidæ hitherto mentioned have the ventrals immediately under the pectorals; but there are others which have them differently placed.

The *Jugular* Percidæ have the ventrals upon the throat farther forward than the pectorals. They comprehend the following genera:—

*Trachinus*, the Weegvers, with the head compressed, the eyes near each other, the mouth obliquely up-

wards, the first dorsal very short, but with a formidable spine on the first ray, the second dorsal long, the pectorals large, and a strong spine on the operculum. These fishes lie in the mud, and inflict severe wounds with their dorsal spine, which the fishermen believe has a poisonous quality, but it is merely rugged, and lacerates an ill-conditioned wound, similar to what is inflicted by the antler of a Stag. *Percis*, which resemble the Weevers, and inhabit the warm seas, have crooked teeth on the maxillaries and the vomer, but none on the palatal bones. *Pinguis*, also of the warm seas, more sluggish than the preceding genus, with the teeth strong and conical, fleshy lips, and teeth on the palate. *Percopis*, with the body very long, some of their teeth long and pointed, and the lower jaw much advanced.

One very remarkable genus of Percidæ is *Uranoscopus*, the Star-gazer, so called because the eyes are placed on the upper surface of the nearly cubical head, and directed toward the heavens. Their pre-operculum is toothed on the lower part; their mouth is cleft vertically; they have a strong spine on each shoulder, and only six rays on each gill. Within their mouth, behind the tongue, is a narrow slip which they can protrude, and with which they attract small fishes, while themselves are concealed in the mud. Their gall bladder is of immense size. One species, *U. scaber*, inhabits the Mediterranean, but none of the others are European. This is a very ugly fish, but still it is eaten.

The third division comprises the *Abdominal Percidæ*, or those which have the ventral fins behind the pectorals.

One genus has them still partially attached to the bones of the shoulder. This is *Polynemus* (many filets), so called because the inferior rays of their pectorals are filled and extended into long threads. Their teeth are in part velvety, like those of the true Perches, and partly also like those of a Carp, and they have them on the maxillaries, the vomer, and the palate. Their snout, however, is rounded, and the vertical fins are scaly. They are found in the waters of warm countries, and one, *P. paradiseus*, of a beautiful yellow colour, with seven filaments from the fin on each side, at least twice as long as the body, is the celebrated "mango fish" of the Ganges, reckoned the most delicious in India. Most of the other species have the filaments shorter, but the flesh of all of them is excellent.

The following genera have the ventrals still farther behind, and the bones of the pelvis quite detached from the bones of the shoulder. Of these there are several:—

*Sphyræna*, the Sea Pike, which has been confounded with the *Esox* or True Pike. They are large fishes, with an oblong head and projecting under jaw. There are several species inhabiting the warmer seas, and one, *S. barracuda*, is as much dreaded as the White Shark. *Paralepis*, small fishes, resembling the last genus in general characters, but with the second dorsal fin small and fleshy. *Mullus*, the Surmullet, a very celebrated genus, and held in much estimation by epicures. These fishes must not be confounded with the Mulletts properly so called, which give name to another family, and are typical of it, being very different in form and appearance from the Surmulletts. The latter have the body thick and oblong, with the profile of the head nearly vertical, the eyes far up, teeth in the lower jaw and palate only, two cirri inwards at the lower jaw, and but four rays in the gills. There are two species, both of which are European, the Striped Red Mullet, *M. surmulatus*, which is not very uncommon on the southern coast of England; and the Plain Red Mullet, *M. barbatus*, which, though named as a British fish, is chiefly found in the Mediterranean. Both species are delicious eating; and the luxurious Romans used to feast their eyes with the changes of colour in the Red Mullet when dying, before they devoured its flesh. *Upeneus* is a genus of the tropical seas, with teeth in both jaws, but none in the palate. They have only four gill-rays, like the Surmulletts, but have also an air-bladder, which the latter are without. These complete the family of the *Percidæ*, as now known.

## THE SECOND FAMILY OF ACANTHOPTERYGII.

### FISHES WITH HARD CHEEKS.

This family comprehends a number of fishes of which the appearance of the head is singular, being variously mailed, or defended by spines and scaly plates of hard matter; but they have many characters in common with the *Percidæ*. Their principal distinction consists in the suborbital bone being more or less extended over the cheek, and articulated with the operculum. The Star-gazer is the only genus of the Perch family which resembles them in this respect; but in it, though the suborbital bone is very broad, it is connected posteriorly with the temporal bones, and not with the operculum.

The following are the principal genera:—

*Trigla*, the Gurnards, so called from the sounds which they utter with their gill-lids when taken out of the water. They have an immense suborbital plate, to which the operculum or gill-lid is articulated by an immoveable suture, so as to be incapable of separate motion. They have the head vertical in the sides, hard and rough bones, two distinct dorsals, three free rays under the pectorals, twelve cœca, and an air-bladder of two lobes. The Gurnards properly so called, have small teeth in both jaws, and in front of the vomer, together with large pectorals, but not sufficiently so for raising them out of the water, like those of the Flying Fishes. There are many species found in the temperate seas, which, though in estimation for the table, are inferior in this respect to the Surmulletts. The English species are *T. cuculus*, the Red Gurnard, with strong plates in the cheeks, the body

lengthened, and nearly round, one spinous and one soft-ray dorsal fin; seven rays in the gills, gill-opening large, and with three free rays at the base of each pectoral. *T. Hirsudo*, the Sapphirine Gurnard, with the pectorals of immense size, but in most of its other characters analogous to the Red Gurnard. It is more abundant than that species, and grows to a larger size. Is rather a dry fish, but the flavour is tolerably good, and it answers very well for salting. There are various other species, chiefly found in the Mediterranean.

The following genera, which are closely allied to the Gurnards, deserve some notice:—*Prionotus*, an American fish, resembling the Sapphirine Gurnard, but with the pectorals so large, that they can support the body during a considerable leap through the air. They have a characteristic band of small teeth, closely crowded together, upon each parietal bone. *Peristidion*, a genus having the whole body mailed with large hexagonal scales, ranged in longitudinal rows. Their muzzle is divided in two, and there are cirri to the mouth, but no teeth. *Dactylopterus*, celebrated as Flying Fishes. They have the subpectoral rays numerous, longer than the body, and united by a membrane, so as to furnish large supplemental fins, by means of which the fishes can protract their fall for a few minutes, when they spring from the water to escape the Coryphenes, and other enemies; but as the fishes cannot fly, or take a new impulse from the air, they speedily fall down and become the victims of the pursuers. They are found in the Mediterranean and Indian Ocean; and are small fishes, seldom more than a foot in length. *Cephalacanthus*, resembles the former, with the exception of the supplementary fins, or wings, as they are sometimes improperly called. *Cottus*, the Bull-head, of which there are several species. They have the head depressed, with teeth in both jaws and in the front of the vomer, the gill-lids furnished with spines; gills with six rays, and large openings, bodies slender, and without scales; two dorsals, near to each other, and the ventral fins small. Of these, *C. gobio*, the Miller's Thumb, is found in rivers; *C. bubalis*, which has the gill-lids very spiny, *C. quadricornis*, with four short spinous processes on the top of the head, are found in the sea: besides these there are some foreign species.

*Apidophorus*, the Pogge, sometimes termed the Armed Bull-head, has the body octangular, and covered with scaly plates, with recurved spines on the snout, and teeth in the jaws only; it is a genus found in the Northern Atlantic and Pacific, but the species are small and unimportant.

Some groups, recently known, have the characters of *Cottus*, and of *Scorpena*. Of these we may notice *Hemirhamphus*, with two dorsals, a bristly head, and no scales on the body; it varies in length from one to two feet, and is found on the American shores. *Hemilepidotus*, has only one dorsal; teeth in the palate, and longitudinal bands of scales, which are not visible till the body is dried; it occurs in the Pacific. *Platycephalus*, is found in the Indian Ocean. It has large ventrals, with six rays placed behind the pectorals; the head depressed, and sharp and spinous at the sides, but not operculated. There are seven rays in the gills, a row of sharp teeth in the palate, and the body covered with scales.

*Scorpena*, of which there are two subgenera, which have the head rough, and hardened with plates, and are compressed laterally; the body is scaly; and there is one dorsal fin. Except in the singular appearance of their armed and tuberculated heads, they very much resemble the Perches. The subgenera are *Scorpena*, without scales, but armed with spines, which are accounted dangerous. They are a gregarious fish, and have their haunts among the rocks. Some allied species have the body much compressed, and a very high dorsal fin, united to the caudal. *Sebastes*, the Norway Haddock, rather a large species, with many spines on the head, a long dorsal, of which the posterior portion has soft rays; the eyes very large, and teeth in all the jaws. It inhabits the northern seas, and the Greenlanders use its spines as needles. *Pterois*, Indian fishes, resembling the last genus, but with no lateral and pectoral rays; remarkably long; their colour very beautiful; and no teeth in the palate. *Blepiatus*, inhabits the North Pacific; has hard cheeks, cirri on the lower jaw, five gill-rays, small ventrals, and one dorsal, consisting of three lobes. *Apistes*, Treacherous, are small fishes, having a formidable spine on the suborbital plate, and branched rays in the pectorals. Some have scales, and some not. *Agriopus*, want the spine of the former, have the dorsal very high, and reaching to between the eyes, a narrow muzzle, and the body without scales. *Pelor*, like *Scorpena* in their teeth; two free rays in the pectorals, head flat, eyes close together, dorsal spines very high, and whole appearance singular. *Synanceia*, as ugly as the former; the head shapeless, tuberculated, and the skin loose. No teeth on the vomer or palate. Like most of the analogous genera, they inhabit the warm seas, and this genus is considered poisonous. *Monocentris*,—body short, thick, completely covered with rough, angular plates, four or five stout spines in place of the first dorsal; each ventral a single large spine; head and mouth large; teeth on the jaws and palate, short and crowded; found near Japan. *Gasterosteus*, Stickleback, a numerous and very common genus, found both in fresh waters and the sea. Named from the free spines on the back, and a bony covering on the belly. Their ventrals, placed behind the pectorals, consist only of a single spine, and they have but three rays and gills. There are several European species, distinguished chiefly by the number and character of their spines. Though of small size, they are exceedingly voracious. *Oreosoma*, a small oval fish, with its body all covered over with scaly cones; only one species is known.

### THE THIRD FAMILY OF THE ACANTHOPTERYGII.

#### SCLENIDÆ (the MAIGRE Family).

These still resemble the Perches in the notches of the pre-operculum and operculum; but they have no teeth on the vomer or palate. The muzzle is thickened, and there are a few scales on the dorsal fins, of which fins some genera have one and others two.

The following are the principal genera:—

*Sciæna*, of which there are seven subgenera. The general characters are,—the head inflated, and supported by cavernous bones; two dorsals, or one deeply notched, the soft part much longer than the spinous; the anal short, the pre-operculum toothed, and the operculum divided into points at its extremity; seven arches in the gills. They resemble the Perches, only they have no teeth in the palate; their whole head is scaly, their air-bladder often curiously fringed, and the stony appendages in the ear larger than in most fishes. The following are the subgenera:—

*Sciæna*, or *Maigres*, properly so called, which have the spines of the anal weak, and neither elongated canine teeth nor cirri at the mouth. One species, *S. umbra*, inhabits the Mediterranean, and used to be highly esteemed, but has latterly become rare. It grows to the length of six feet or more. Some other species of this subgenus are found in the Southern and Indian Seas.

*Otolithus*, has the anal spines weak, and no cirri, some elongated or canine teeth, and two horns attached to the air-bladder, and erected forwards. They are Indian and American fishes; one is known as the Stone Perch of Pondicherry. *Ancylodon*, resembles the former, but has a short muzzle, long canine teeth, and a pointed tail.

*Corvina*, small and crowded teeth, with neither canines nor cirri; the second anal spine rather strong. One, species, *C. nigra*, is abundant in the Mediterranean, and there are others in the Indian and American seas. *Johnius*, resembles the last, but has the second anal spine weaker, and shorter than the soft rays. They are found in the seas of India, Tropical Africa, and America, and are esteemed as food, their flesh being white and easy of digestion. *Umbrina*, distinguished by a cirrus on the lower jaw. A remarkably beautiful fish, found plentifully in the Mediterranean, and occasionally on the southern coasts of Britain. Its ground colour is golden, with bright bands of steel blue; and its flesh is excellent. It is not a very long fish, but is sometimes forty pounds in weight. *Pogonias*, somewhat like the former, but with several cirri below the jaw. Some of them are silvery, and attain the size of an *Umbrina*. This fish produces much more sound than any of the other *Sciænidæ*, on which account it is sometimes called the Drum-fish.

*Eques*, has a long and compressed body, elevated at the shoulders, and tapering to the tail; the teeth are small and closely set; the first dorsal is high, the second long and scaly; and they all belong to the American seas.

The *Sciænidæ* with a single dorsal fin, are subdivided according to the number of the gill-rays. Those which have seven, correspond to some genera of the *Sparidæ*, and have the pre-operculum always notched. The following genera have seven gill-rays:—

*Hæmulon*, has the muzzle lengthened, resembling that of a Hog; the lower jaw compressed, opening very wide and of a bright red. Hence they are called "Red-throats" in the West Indian Islands. Their teeth are small, and closely set; and their dorsal fin is slightly notched, having the soft part scaly. They inhabit the American seas.

*Pristipoma*, have pores in the jaw, like the last species, but the muzzle thicker, the mouth not so deeply cleft, and their dorsal and anal fins without scales. The obtuse angle of the operculum is concealed by a membrane. They are numerous, and inhabit the warm latitudes of both oceans.

*Digramma*, resemble the last-named, except that the cavity of the symphysis is wanting, and there are two large pores beneath each side. They are found in both oceans. Those of the Atlantic have large scales, and those of the Indian Ocean smaller, and a shorter and thicker muzzle.

The *Sciænidæ* with a single dorsal, and less than seven gill-rays, admit of more subdivision. Some have the lateral line extending to the caudal fin, others have it interrupted. The following genera possess the former character:—

*Lobotes*, have the muzzle short, the lower jaw prominent, the body high, and the posterior angle of the dorsal and anal fins so elongated, as, with the rounded caudal fin, to appear in three lobes. There are four groups of very small points near the end of the jaw. They inhabit both oceans.

*Cheilodactylis*, have the body long, the mouth small, many spinous rays in the dorsal, and the lower rays of the pectorals simple, and produced beyond the membrane.

*Scolopelodes*, have the second suborbital plate toothed, and terminated by a point directed backwards, crossing another point of the third suborbital, directed the contrary way. The body is oblong, mouth little cleft, teeth velvety, scales large, and no pores in the jaws. They inhabit the Indian seas.

*Micropteres*, have the body oblong, three spines on each side of the jaw, and the last rays of the soft part of the dorsal separated from the others, and forming a small peculiar fin. They have the operculum without notches.

The *Sciænidæ* with less than seven gill-rays, and the lateral line interrupted, form several genera of small oval fishes, generally finely coloured, and distinguished by the armature of their heads. They have a nearer relation to the genus *Chatodon*, and resemble some of the fishes with labyrinthic branchiæ. The following are the genera:—

*Amphitriton*, with the pre-operculum and three operculum pieces denticulated, the latter produced on a single row of blunt teeth.

*Pomacentres*, have the pre-operculum denticulated, the operculum without armature, and a single row of trenchant teeth. *Premnas*, have one or two stout spines on the suborbital, and the pre-operculum toothed. *Dascyllus*, resemble *Pomacentres*, except in having the teeth very small, and thickly crowded. All the genera inhabit the Indian seas.

*Glyphisodon*, with the gill-lids entire, and a single row of trenchant and generally notched teeth. They are found in the Atlantic, but more abundantly in the Indian seas.

*Heliatus*, resemble the preceding genus in their operculum, but have the teeth small and velvety.

## THE FOURTH FAMILY OF THE ACANTHOPTERYGII.

## SPARIDÆ (the SEA-BREAM Family).

These have no teeth in the palate; their general figure resembles that of the preceding family; their bodies have scales larger or smaller, but they have none on the fins; their muzzle is not thickened, nor the bones of the head cavernous; they have no notches in their preoperculum, nor spines on the operculum; their pylorus has cæcal appendages; they have six gill-rays, which are arranged according to the form of the teeth. The first tribe, of which there are five genera, have the sides of the jaws set with round, flat teeth, resembling a pavement. The genera are as follow:—

*Sargus*, with cutting teeth in the front, like those of Man; but in some species the teeth vary.

*Chrysophris*, Gilt-heads, with round grinders in the sides of the jaw, and a few blunt conical teeth in front. There are two European species: *C. auratus*, a large and beautiful fish, with a golden eyebrow; and *C. microdon*, with the teeth smaller, and the profile fuller. The first species is occasionally found on the south coast of England. They have very strong teeth, and are able to break the hardest shells of the Mollusca.

*Pagrus*, has only two rows of grinders.

*P. vulgaris*, silvery, glossed with red, inhabits the Mediterranean, and is occasionally met with on the English shores. There are others in the Atlantic and the Indian Ocean, and one of Southern Africa, which has the jaws as hard as stone.

*Pagelus*, has the teeth smaller, and the muzzle more elongated. *P. erythrinus*, the Spanish Bream, is silvery, glossed with rose-colour: it is a very beautiful fish. There are numerous others found in the Mediterranean and other seas; but the species named is the only one that occurs on the English coast, excepting the Sea Bream, *P. centrodentus*, which is of the same colour as the former, but has a large dark patch on the shoulder.

*Dentex*, has all the teeth conical, and the front ones hooked. One species, *D. vulgaris*, occasionally occurs in the south of England, and there are various others.

Some have the mouth less cleft, the body lower, and the caudal scaly to the end; and others have no scales on the cheek, but a pointed scale between the ventrals, and one above each of them. These form a second tribe of the family; and a third tribe also consists of a single genus,—

*Cantharus*, which has crowded teeth, hooked, and placed cardwise round the jaws. One species, *C. griseus*, of a silvery grey colour, with brown longitudinal stripes, is found on the English shores, and known as the Black Bream.

The fourth and last tribe consists of two genera:—

*Boops*, with the mouth small, and the external teeth trenchant. There are several species in the Mediterranean, silvery or steel-coloured, with longitudinal golden stripes. *Oblada*, with small crowded teeth behind the trenchant ones; silvery, with blackish stripes, and a broad black spot on each side of the tail.

## THE FIFTH FAMILY OF THE ACANTHOPTERYGII.

## MENIDÆ.

These differ from the last in the great extensibility of the upper jaw, which is advanced or withdrawn by means of long intermaxillary pedicles. It contains only the following four genera:—

*Mæna*, with fine narrow teeth in the jaws, and a band of the same on the vomer; body shaped like that of a Herring, lead-coloured on the back, silvery on the belly. *Smaris*, want the teeth on the vomer, and the body is less elevated. *Cæcio*, has the dorsal somewhat higher. *Geres*, mouth protractile, jaw descends in advancing, and teeth in the jaws only: much esteemed for food. The first two genera inhabit the Mediterranean, the third the Indian Ocean, and the fourth the Atlantic, whence a stray individual sometimes reaches the coast of England.

## THE SIXTH FAMILY OF THE ACANTHOPTERYGII.

## SQUAMIPENNES (Scaly-finned).

These fishes are so designated because the soft, and often the spinous parts, of their dorsal fins are so covered with scales as not to be easily distinguished from the rest of their bodies. This is the most distinguishing character; but they also have, in general, the body much compressed, and the intestines long, and with numerous cæca. Linnæus included all those known in his time in the genus *Chætodon*, or bristle-teeth, from the thinness and close array of these parts; but this genus admits of subdivision, and there are some others.

The *Chætodons* have their teeth like a brush, their mouth small, their dorsal and anal fins scaly like the body, so that it is difficult to say where the fin commences. They abound in the seas of warm

climates, and are remarkable for the beauty of their colours. Their intestines are long, with numerous cæca, and their air-bladders are large and strong. They frequent rocky shores, and are eaten. The following are the genera :—



Fig. 133.—*Chatodon rostratus*.

be a very foul feeder. Many of this genus are found fossil in Mount Bolca in Italy, which is a vast magazine of petrified fishes.

*Holocanthus*, have a strong spine on the operculum, with the edge of that toothed. They are found in the warm latitudes of both oceans. Their flesh is excellent, and the colours beautiful, and regularly marked.

*Pomacanthus*, have the body more elevated from a sudden rise of the edge of the dorsal. They are only known as American.

*Platex*, has trenchant teeth, with three points in front of their brush-like ones, and their body strongly compressed, and continued into thick, elevated, and scaly fins, with a few concealed spines in the anterior edge, so that the height is much greater than the length. They inhabit the Indian Ocean, but a fossil species has been found at Bulca.

*Psettus*, resembles *Platex*, but has all the teeth small and crowded; and the ventrals, which are very long in that, reduced to a small spine, without soft rays. They are of various forms, and known only as inhabitants of the Indian Ocean.

*Pimelopterus*, with a single row of teeth placed on a horizontal base or heel, and trenchant in the anterior part. The body is oblong, the head blunt, and the fins thickened with scales, whence the name. They inhabit both oceans.

*Diplarodon*, an analogous genus, with trenchant teeth, chisel-shaped, and the spinous and soft parts of the dorsal separated by a deep notch. Found in the Southern Ocean.

The following genera, which are ranged with *Chatodon*, on account of their scaly fins, yet differ from them in having teeth on the vomer and palate :—

*Brama*, Ray's Bream, has the body deep and compressed, the profile almost vertical, one elongated dorsal fin, scales on the dorsal and anal, and slender curved teeth on the jaws and bones of the palate. It is found in the warmer seas, but is occasionally met with on the shores of England.

*Pempheris*, has a long and scaly anal, the dorsal short and elevated, and an obtuse profile and large eye; a small spine on the gill-lid, and small crowded teeth on the jaws, vomer, and palate. Inhabits the Indian seas.

*Torotes*, the Archer, has the body short and compressed, the dorsal far backwards, the snout short and depressed, and the lower jaw projecting beyond the upper one. It has small teeth crowded in all parts of the mouth, and the gill-lids finely toothed. It hits insects with drops of water at the height of three or four feet above the surface, and is remarkably sure of its aim.

## THE SEVENTH FAMILY OF THE ACANTHOPTERYGII.

### SCOMBERIDÆ (the MACKEREL Family)

This family comprises a vast number of genera, many species, and countless individuals. They are eminently useful to Man, and are the object of some of the most extensive fisheries. Many of them were included by Linnæus in one genus, *Scomber*, but they are subdivided as follows :—

*Scomber*, the Mackerel, with the body spindle-shaped, beautifully coloured, smooth, and with small scales. The common Mackerel is well known as one of the most valuable of the fast-swimming surface

fishes, for the rapidity with which it dies when out of the water, and also becomes putrid, or tainted. There are several species in the European and American seas.

*Thynnus*, the Tunny, has a soft corselet of large scales on the thorax, a cartilaginous keel between the crests and the sides of the tail, and the first dorsal approaching the second. It is very abundant in the Mediterranean, where it sometimes attains the length of fifteen or eighteen feet. It is captured in vast numbers, and forms an



Pilot-fish of the Mediterranean is not above  $\frac{1}{2}$  foot long; but it is swift and voracious, and follows in the wake of ships along with the Shark, which it has been erroneously supposed to lead, and hence its name of *Ductor*. A black species of the South American coasts has been found eight or nine feet long.

*Belacates*, form and dorsal spines like the last, but the head flattened, and the keel and anal spines wanting.

*Lichia*, has dorsal and anal spines on the back, one of the former lying flat and directed forwards, but the body is compressed, and no keels on the tail. There are several species in the Mediterranean, all eatable, and some of large size. *Trachinotus* merely has the body a little more elevated, and the dorsal and anal longer and more pointed.

*Rhynchobdella*. Spines as in the former genus, long body, and no ventrals. The subgenera are,—

*Macrognathus*: has a pointed, cartilaginous muzzle, projecting beyond the lower jaw, and the dorsal and anal separate from the caudal. *Metacembelus*: jaws equal, and dorsal and anal joined to the caudal. Both inhabit the fresh waters of Asia, and feed on worms, in search of which they plough up the sand with their cartilaginous noses: their flesh is much esteemed.

This is the place for the imperfectly known genus *Notacanthus*, which has the muzzle of the last, free spines for a dorsal, ventrals abdominal, a long anal reaching to the top of the tail, and joining a very small caudal. The known species inhabit the Arctic Ocean, and have been found two feet and a half long.

*Seriola*. This genus resembles *Lichia*, has a horizontal spine before the dorsal, but the dorsal spines united by a fin, a small fin with two spines before the anal, and no keel on the lateral line. One species is the Milk-fish of Pondicherry, so much esteemed for the delicacy of its flesh. There are several other species in both oceans.

*Nomeus*, resemble the last, but have large ventrals attached to the abdomen by their inner edge; colour, silvery, with transverse black bands on the upper part. Has been confounded with the Gobies.

*Temnodon*: tail unarmed, spines or small fins before the anal, first dorsal small, second and anal small, scales, one row of trenchant teeth in each jaw, with small crowded ones behind, and on the vomer, the parietals, and tongue; seven rays on the gills, and the gill-lid forked. There are species common to both oceans, and about the size of the common Mackerel.

*Caranx*, have the lateral line with scaly plates, keeled, and often spinous, horizontal spine before the first of the two dorsals, last rays of the second dorsal often detached, some spines or a small fin before the anal. Several species in the European seas, and generally over the globe. Resemble Mackerel, and are called Bastard Mackerel. [On the British shores they are designated Scad or Horse Mackerel, and they sometimes make their appearance in immense shoals, literally "banking the sea," especially along the Cornish coasts, and shores of the Bristol Channel. They feed on the fry of Herrings, and are not in much estimation as food.]

*Vomer*. This genus have the body more and more compressed and elevated in the different subgenera, while the armature on the lateral line diminishes, and the skin becomes smooth like satin, without any apparent scales. They have no teeth, except short and fine ones crowded together; and the subgenera are chiefly distinguished from each other by various filamentary prolongations of some of the fins. Linnæus and Bloch included them, but improperly, in the genus *Zeus* (Dory). The following are the subgenera:—

*Olistus*. These resemble *Situle*, a subgenus of *Caranx*, but the middle rays of the second dorsal are not branched, but merely articulated, and extend in long filaments.

*Scyris*. Nearly the same in form and filaments, but the spines of the first dorsal hidden in the edge of the second, and the ventrals short.

*Blepharis*, has long filaments to the second dorsal and anal, the ventrals very long, and the spine scarcely above the skin; their body is very elevated, but their profile not so vertical as that of some of the other subgenera found in the warm seas; and in the West Indies one species is called the "Cobbler." *Gallus*, similar to the last in all respects except having the profile more vertical. *Argyrosteus*, has the profile still more vertical, the first dorsal definitely formed, and some of its rays extended in filaments, as well as those of the second dorsal; the ventrals are also very long.

*Vomer*, properly so called, has the body compressed, and the profile vertical, as in the two subgenera immediately preceding it, but none of the fins are extended into filaments.

*Zeus*. After removing the analogous subgenera of *Vomer*, this genus comprehends

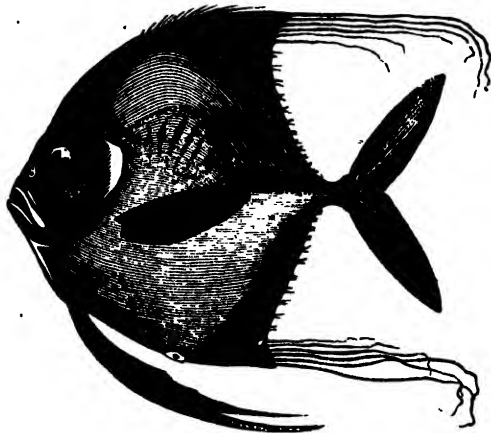


Fig. 136.—*Blepharis*.

fishes with the mouth greatly projectile, and few and weak teeth. They differ much, and require division into various subgenera.

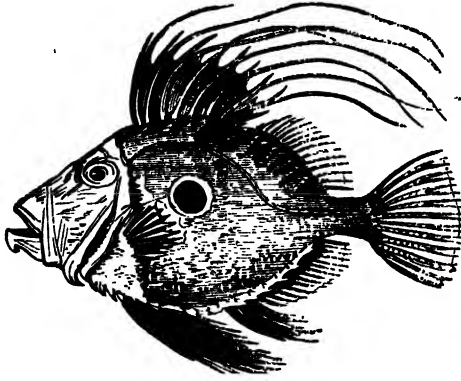


Fig. 137.—The Dory.

*Capras*, the Boar-fish, has the notched dorsal of the Dory, but no spines along the dorsal or anal; it has the mouth still more projectile than the Dory, the body covered with rough scales, and the fins entirely without filaments. [Its flesh in little esteem.]

*Lampris*, has a single dorsal very high anteriorly, as also is the anal, which has one small spine before its base; sides of the tail with keels; ventrals and caudal lobes very long, but subject to be worn away; colour, violet, spotted with white, and the fins red. Inhabits the Arctic seas, and grows to a large size. [In Britain it is known as the Opah, or King-fish.]

*Eguula*. One dorsal with several spines, the foremost occasionally long, snout much protracted, body compressed, and edges of the back and belly toothed with fins. They are small fishes, several of which inhabit the Indian Ocean, and some of them have the power of contracting the snout when at rest, and projecting it suddenly for the capture of those small fishes on which they feed.

*Menas*, has the snout as in the last, but the body more compressed, the abdomen trenchant and very convex, but the back nearly straight; the ventrals are behind the pectorals, but still attached to the shoulder. One only is known, of the Indian Ocean, silvery, with a black spot near the back.

*Stromateus*. This genus has the same compressed form as *Zeus*, and the same smooth epidermis; but the muzzle is blunt, and not protractile. It has a single dorsal, with a few concealed spines anteriorly, but no ventrals. The vertical fins are thickened as in the scaly-finned fishes; the gullet has a number of spines attached to the membrane. They are found in the Mediterranean, the Indian Ocean, and Pacific. Some of the species differ a good deal in form.

*Peprius*, has the pelvis trenchant and pointed before the vent, resembling rudimental ventrals, and some species have this part toothed.

*Luvarus*, resembles the former, but has no trenchant blade on the pelvis, only a small scale, which covers the vent, and a prominent keel on each side of the tail. A large species, silvery, with a reddish back, is found in the European seas.

*Seserinus*. All the characters of the last genus, save that there are little rudiments of ventrals. One small species is known in the Mediterranean.

*Kurtus*, resemble *Peprius*, but differ in having the dorsal shorter, and the ventrals larger; the anal is long, and the scales so minute as to be invisible till the skin is dried. They have seven gill-rays, a spine between the ventrals, and some small trenchant plates before the dorsal, which has a spine directed forward at its base. The ribs are dilated, convex, and form a continuous annular tube, which extends so far under the tail, and contains the air-bladder. Some have a little cartilaginous horn in advance of the plates before the dorsal. They are found in the Indian seas.

*Coryphæna*, Dorades, or Gold-fishes, the Dolphins of the ancients, and of the modern Hollanders. They have the body long, compressed, and covered with small scales; the head trenchant in the upper

*Zeus*, the Dory, has the first dorsal deeply notched between the spines, and the intermediate membranes extend into long filaments, together with the forked spines along the bases of the dorsals and the anal. One species, the Common Dory (John Dory) is yellowish brown, with golden or silvery reflections, according to the position of the light, with a round black spot margined with white on the shoulder. [The Dory has been a renowned fish since the days of the ancients, who styled it not the fish of Jove, but *Zeus*, that is, Jove himself. The religious also claimed it as the "Tribute-money-fish," from the black marks of the thumb and fingers of St. Peter on the shoulders, in which it is the rival of the Haddock—neither of which fishes Peter had any chance of seeing. It is still held in great estimation by epicures; and being a ground fish, it keeps two or three days, and is all the better for it.]

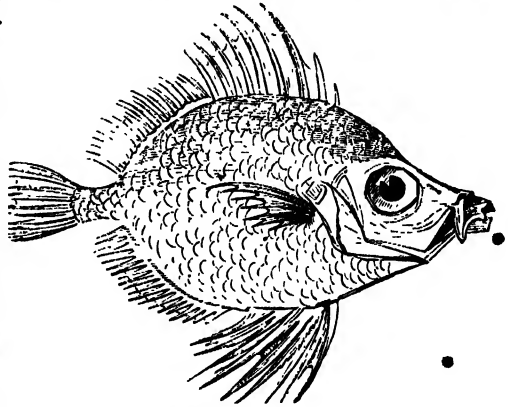


Fig. 138.—The Boar-fish.

part; a single dorsal, which extends the whole length of the back, with flexible rays the whole length, but the anterior ones not jointed; and they have seven rays in the gills. The following are the subgenera:—

*Coryphæna*, the Coryphene, properly so called, have the head much elevated; the profile curved, and descending rapidly; they have teeth in the palate, as well as the jaws. They are large and splendidly-coloured fishes, celebrated for the velocity of their motions, and the havoc which they commit among the Flying Fishes. [*C. hipparis*, the Common Coryphene, is found in the Mediterranean and Atlantic. It is a brilliant fish, and drives through the water like a radiant meteor. Its long dorsal is sky-blue, with the rays gold-coloured; its tail-fin green; its back green, mottled with orange; and its belly silvery, divided from the former by a yellow lateral line. As it passes along, however, there is an extraordinary play of colours upon it; and it is one of the fishes with the changes of whose colours, when dying, the luxurious Romans used to gloat their depraved fancy. Some of the Indian species are brighter coloured than this one; and, indeed, all the Scomberidæ have a tendency to get blackish in the cold seas, and brilliant in the warm ones, owing to the greater effect of the solar light in the latter; for the sunbeam is Nature's pencil, down even to the deepest fish or pearl shell].

*Curranamores*, differ from Coryphene in having the head oblong, and less elevated, and the eye in a medium position. *Centrolophes*, has no teeth in the palate, and a plain space between the occiput and the dorsal. [One species, the Black Fish, *C. pompiilus*, occasionally wanders from the Mediterranean to the southern shores of Britain. It is a powerful fish, and not easily caught, but its flesh is much esteemed. It feeds partially on some sea-weeds, but chiefly on other fishes.]

*Astrodermus*, has the head and dorsal like the Coryphene, but the mouth small, four rays in the gills, and the ventrals very small in the throat. The scales are thinly scattered over the body, arranged into stars, hence the name. Only one species is known, which inhabits the Mediterranean; is silvery, spotted with black, and has a very long dorsal. The fins are red.

*Pteraclis*, teeth and head like the Coryphene, but the scales larger; ventrals on the throat small; dorsal and anals as high as the fish.

[Such are the leading genera and subgenera of the Mackerel family, one of the most numerous and splendid in the class.]

## THE EIGHTH FAMILY OF THE ACANTHOPTERYGII.

### TÆNIDÆ (Ribbon-shaped).

This family is closely allied to the Mackerels, its first genus agreeing intimately with the last subgenera of Scomber. The fishes composing it are long, flattened on the sides, and have very small scales. One tribe has the muzzle elongated, the mouth deeply cleft, with strong trenchant teeth, and the lower jaw projecting beyond the upper. This tribe contains only two genera.

*Lepidopus*, the Scabbard-fish, or Scale-foot—from the form of the ventrals, which are merely two scaly plates. The body is thin and elongated, with a dorsal above, and a low anal beneath, terminating in a well-formed caudal. The gills have eight rays; the stomach is long, with more than twenty cœca near the pylorus; and the air-bladder is long and slender, with a glandular body attached. One species, *L. argyreus*, occurs from England to Southern Africa, but is not plentiful. It is sometimes five feet long, but it is rare. [It swims with extreme rapidity, and often with the head above water. It has no scales on the body, except the two which occupy the place of the ventral fins.]

*Trichurus*, Hair-tail. The body, muzzled jaws, and teeth like the last, and a dorsal extending along the back; but no ventral, anal, or caudal fins, excepting a few obscure little spines on the under side of the tail, which terminates in a hair-like point; there are seven rays in the gills; the stomach is long and thick; the intestines striped with numerous cœca; and their air-bladder long and simple. Viewed laterally, they resemble beautiful silver ribbons. There are several species of the Indian Ocean, and one at least of the Atlantic. [One, *T. lepturus*, called by some the Blade-fish—in contrast, we suppose, to the Scabbard-fish—occurs occasionally in various parts of the British seas. It is shining silvery, with greyish-yellow fins; the dorsal mottled with black on the edge; the irides are golden]. Some of the Indian Trichiuri have been described as having electric or galvanic properties, but such is not the fact.

A second tribe comprehends genera which have the mouth small, and little cleft.

*Gymnetrus*, has the body elongated, and flat, without an anal fin, but with a long dorsal, a caudal composed of few rays, and ventrals under the pectorals, which are fibrous, with small expansions at their extremities, but both they and the anterior of the dorsal are liable to be broken. The fishes themselves are very tender, their bones soft, their fins easily rent, and their flesh soon decomposed. They occur in the Mediterranean, the Indian, the Atlantic, and the Arctic Seas. Some of them are ten feet in length. [Two species have occurred in the British seas:—*G. Hawkenii*, on the coast of Cornwall, and *G. arcticus*, on some of the northern coasts; but the last species is not very satisfactorily made out, as the tenderness of the fish causes it to be mutilated almost the instant it is stranded.]

*Stylephorus*, has a caudal fin, as in the last, but shorter; and instead of the tail ending in a hook in the middle of the fin, as it does there, it is produced in a filament longer than the body.

A third tribe has the muzzle short, and the mouth cleft obliquely. It contains three genera.

*Sepola*, have a long dorsal and anal, the top of the cranium flattened, the gape inclining upwards, all the spines of the dorsal flexible, but those of the ventrals stiff, cavity and stomach very short, and the air-bladder extending as far as the tail. One species, of a reddish colour, inhabits the Mediterranean; [and is occasionally found on the south coast of England, where it is known as the Red-band Fish, or Red Snake-fish. They appear to have little command of themselves in a stormy sea]. *Lophotes*, head short, with an osseous crest surmounted by a spine, bordered behind this with a low fin, extending from this spine to the tail, which has a very small caudal; the anal very short, pectorals moderate, and scarcely any ventrals; teeth pointed, eyes very large, and abdominal cavity occupying nearly the whole length of the body. One species is known in the Mediterranean, where it attains a large size.

## THE NINTH FAMILY OF THE ACANTHOPTERYGII.

### THEUTYES (the LANCET-FISH Family).

These agree with the Mackerel family in some respects, but differ in others, such as trenchant spines on the sides of the tail, and an horizontal spine before the dorsal. The family contains few genera, all foreigners, with compressed oblong body, small mouth, slightly or not at all protractile, and only a single row of trenchant teeth in the jaws. They feed chiefly on fuci and other marine plants, and have large intestines. [Their powerful spines, which they use very dexterously, are weapons of defence supplied to them for nearly the same purposes as the horns of the ruminant Mammalia.]

*Stiganus*, have a unique character in their ventrals, which have two spinous rays, one external and the other internal, and three branch rays between them. They have five gill-rays, a horizontal spine before the dorsal, and the styloid bones of the shoulder so curved as to unite at their extremities with the first interspiral bone of the anal. There are numerous species in the Indian Ocean.

*Acanthurus*, Lancet-fishes, have the teeth trenchant and notched, and a strong spine at each side of the tail, as sharp as a lancet, with which they inflict severe wounds on such as attempt to handle them unwarily; hence their common name. They are found in the warm parts of both oceans: some with the dorsal very elevated, others with a tuft of bristles before the lateral spine, and others again with the teeth divided like a comb.

*Prionurus*, differ from the last only in having a number of horizontal cutting-blades on the side of the tail, in place of the strong spine. [These might be termed Scarifiers.]

*Naseus*, have trenchant blades in the tail like the last, but with conical teeth, and a prominent horn projecting over the muzzle; only four rays in the gills, and three in the ventrals. Their skin is leathery.

*Axinurus*, more elongated than the last, and without the prominence in front, but with the same number of rays in the gills and ventrals; on each side of the tail, they have a single square cutting-blade, without a basal shield; their mouths are small, and their teeth slender.

*Priodon*, have the notched teeth of *Acanthurus*, the three soft ventral rays of *Naseus*, and the sides of the tail armed like *Synganus*.

## THE TENTH FAMILY OF THE ACANTHOPTERYGII.

### FISHES WITH LABYRINTHS IN THE PHARYNX.

By the term *Pharyngina labyrinthiforme*, is meant that the upper membranes of the pharynx are divided into small irregular leaves, more or less numerous in the different genera, containing cells between them, which the fish can at pleasure fill with water; and by ejecting a portion of this water, moisten its gills, and thus continue its circulation while out of its proper element. [From this contrivance of Nature herself, we are to understand that, if the gills of a fish can be kept properly moistened, by salt water or by fresh, according as the fish is naturally an inhabitant of one or the other, it may be carried alive over land to an indefinite distance]. By means of this apparatus, these fishes are enabled to quit the pool or rivulet which constitutes their usual element, and move to a considerable distance over land. This singular faculty was unknown to the ancients; and the people in India still believe that these fishes fall from heaven.

[In cold and temperate climates, this apparatus is not necessary, because all the ponds and streams there, which are capable of supporting fish, are perennial, and never dried up, except in seasons of extreme drought, when, of course, all the fishes perish; but in tropical countries, and in India perhaps above all other tropical countries, where the seasons are alternate drought and rain, there is neither food nor water for a fish during the one season, and plenty of both during the other. Hence, these fishes are furnished with this peculiar apparatus in the pharynx, by means of which they are enabled to follow the water over dry obstacles, and, in some of the species, to climb steep banks, or even trees, in the course of their instinctive journeys]. The following are the genera:—

*Anabas*, the Climbing Perch of India. This genus has the labyrinths highly complicated; the third pharyngi have pavement teeth, and there are others behind the cranium; the body is round in the section, and covered with strong scales; the head is large, the muzzle short and blunt, and the mouth small; their lateral line is interrupted for the posterior third; the margins

they swallow entire]. There are several species found in the European seas, of which the flesh is much esteemed.

*M. cephalus*, the Grey Mullet, has the eyes half covered by two adipose membranes, adhering to the anterior and posterior margins of the orbit; when the mouth is closed the maxillary is completely hidden under the suborbital; the base of the pectoral has a long crest with a keel; the nostrils are separated by a considerable space, and the teeth are a little prominent. It is the largest and best of the Mediterranean species. [It occurs also on the British shore, though, perhaps, not so frequently as another species, the Thick-lipped Grey Mullet, *M. chelo*. The two are, however, sometimes confounded with each other. In addition to these, there is another Grey Mullet, first described by Mr. Yarrell, and which, from its shortness in proportion to the length, he has called *M. curtus*. With the exception of its form, its small size, and some difference in the rays of the pectoral, anal, and caudal fins, it bears considerable resemblance to *M. cephalus*.]

*M. capito*, the Ramando of Nice, has the maxillary visible behind the commissure of the jaws, even when the mouth is shut; its teeth are much weaker: its nasal openings nearer to each other; and the membrane of the eye does not cover any part of the ball. The scale before the pectoral is short and blunt, and there is a black spot at the base of that fin.

Two much smaller species (*M. aureus* and *M. saltator* of Risso) resemble *M. capito*. The first has the maxillaries under the suborbitals, like *Cephalus*, but the nostrils are near each other, as in *Capito*. The second, with the characters of *Capito*, have the suborbital notched, showing the maxillary.

*M. chelo*, is common in the Mediterranean and the Atlantic. It is easily distinguished by its thick fleshy lips, by their ciliated edges, and by the teeth which penetrate their substance like hairs. The maxillary is curved, and appears behind the commissure. *M. labio*, a small American species, has proportionally larger lips, with their margins curved. There are also some thick-lipped species in the Indian seas. [There seems little doubt that *Chelo* is the Grey Mullet, which is so frequently taken in the bays and estuaries on the Channel coast, although not the one generally described as such].

*Tetragonurus*, is so named from the projecting keels or ridges on each side, near the base of the caudal. It is also one of those insulated genera which indicate particular families, [rather than belong to any of those established ones]. They in part resemble the Mulllets, and in part the Mackerels. Their body is elongated; their spine is dorsal, long, but very low; their soft dorsal, which approaches the other, higher and shorter; their anal is opposite the soft dorsal, and their ventrals a little behind the pectorals; the sides of the lower jaw are raised vertically, and furnished with a single row of treacher teeth like a saw, and inclosed, when the mouth is shut, by the upper teeth; there is also a small range of teeth upon each parietal bone, and two on the vomer; the gullet is furnished internally with hard and pointed papillæ; their stomach is fleshy, and doubled; their cæca numerous, and their intestinal canal long. Only one species is known, an inhabitant of the Mediterranean, about a foot long, and black; its flesh is believed to be poisonous.

*Atherina*, is a genus which does not completely harmonize with any other, and therefore it is arranged between the Mulllets and the Gobies. It has a lengthened body, two dorsals far apart, ventrals behind the pectorals, the mouth protractile, and furnished with very small teeth. All the known species have a broad silvery band along each flank. They have six gill-rays; their stomach is a cul-de-sac, and no cæcal appendages. The last transverse process of the dorsal vertebrae are bent, forming a sort of conical receptacle for the end of the air-bladder. They are small fishes, much esteemed for the delicacy of their flesh; and the fry remain a long time in shoals along the shores, and are consumed in great numbers. Four species are found in the Mediterranean, and there are a good many foreign ones. [*A. presbyter*, is found on the south coast of England, and also on the east coast as far as Lincolnshire, and in the Firth of Forth, but not abundantly. On the coasts of Hampshire and Sussex it is plentiful; and on the Cornish coast it is taken at all seasons. It is a handsome little fish, about six inches long, known as the Sand Smelt, but inferior in flavour to the true Smelt.]

## THE TWELFTH FAMILY OF THE ACANTHOPTERYGII.

### Gobioidæ (the Goby Family).

The fishes of this family are known by the thinness and flexibility of their dorsal spines. They all have the same kind of viscera,—namely, a long, uniform, intestinal canal, without cæca, and no air-bladder. [The family contains several genera, some of which admit of subdivision].

*Blennius*. The Blennies have one well-marked character in their ventral fins, inserted before the pectorals, and having only two rays each. The stomach is slender, with no cul-de-sac; the intestine large, without cæca, and there is no air-bladder. The form is elongated and compressed, and there is but one dorsal, composed almost entirely of jointless but flexible rays.



Fig 110.—Blennius.

They live in small troops, among rocks near the coast, swimming and leaping, and can exist for some time without water. Their skin is covered with a mucous secretion, whence they have their common name Blennies. Many of them are viviparous, or bring forth their young alive, fully formed, and capable of subsisting by themselves. They are divided as follows:—

*Blennies*, properly so called, have the teeth equal and closely set, forming only a single and regular row in each jaw, but terminating behind, in some of the species, by a longer and crooked tooth; their head is blunt, their profile vertical, and their muzzle short. Most of them have a fringed appendage over each eye, and some have another on each temple. Their intestines are wide and short. The following are some of the more remarkable species:—*B. ocellaria*, Ocellated Blenny, or Butterfly-fish. This has two lobes in the dorsal, the first marked with a round black spot surrounded by a white ring, and then a black one. It is a native of the Mediterranean, [but is occasionally found in the South of England by dredging. It lives among the rocks and sea-weed, and is understood to feed on minute Crustacea and Mollusca. It spawns in spring. It is a very small fish.] *B. tentacularis* has four filaments on the head, the dorsal fin even, and a black spot on the fourth and fifth rays. [It is not named among the English Blennies.] *B. gattorugine*, has the dorsal nearly even, and only two filets on the head. [It is found on the Cornish shores, varying in length from one inch to five. The general colour is reddish-brown, paler on the belly.] *B. palmicornis*, has the appendage over the eye fringed, and the dorsal almost quite even, the anal long, and the caudal rounded: [it is found on various parts of the British shores, and even as far north as Norway. It is usually of small size, and pale brown, mottled with dark dull brown]. In some the appendages over the eyes are hardly visible, but they carry a prominent membrane on the top of the head, which becomes red and inflated in the pairing season. Of these there are several in the European seas. *B. galerita*. [Head blunt and rounded, body smooth, compressed, and clammy, one long dorsal fin, ventrals before the pectorals, with only two rays each, and both joined at the base. This is an insignificant species, found occasionally on the British shores, but, like most of the genus, quite valueless.] *B. rubiceps*, has the first three rays of the dorsal elevated, with red points, and the top of the head of the same colour. *B. pholis*, has the head without any appendages, the dorsal notched, and the pectorals rather large. [It is found on the British shores, and is remarkably tenacious of life, being capable of living a good many days if kept in moist grass or moss: like the rest, it is of trifling value.]

The following subgenera are separated from the Blennies, properly so called:—

*Myxodes*, with the head lengthened, the muzzle pointed, and projected in advance of the mouth; a single row of teeth, but no large or canine ones.

*Salarias*, have the teeth in a single row, placed close, hooked, but very slender and numerous. In a recent specimen they yield to the touch like the keys of a musical instrument. The head is much compressed above, and enlarged transversely below; their lips are fleshy and thick; their profile is quite vertical. Their intestines have spiral convolutions, and are longer and more slender than in the Common Blenny. They are found in the Indian Ocean only.

*Clinus*, have short pointed teeth, dispersed in several rows; their muzzle is less obtuse than in the former; the stomach is more ample, and the intestines shorter. There are some variations of character.

*Cirrhibarba*, resembles *Clinus* in shape, has small curved teeth, a little filament over the eye, one in the nostril, three larger ones at the end of the muzzle, and eight under the point of the lower jaw. Found in India.

*Murenoides*, the Spotted Gunnel, or Butter-fish, has the ventral smaller than in any of the rest, often only a single ray; head small; body lengthened like a sword-blade; a low dorsal, extending the whole length of the back; teeth like *Clinus*; and the stomach and intestine have a uniform appearance. [Found generally in the European seas, even as far north as Greenland, where it is eaten. There it is said to grow to the length of ten inches, but on the British shores it is seldom more than six. The mucous secretion of the skin is very copious.]

*Opistognathus*, resembles the true Blennies in form, especially its short snout; has large maxillaries prolonged backwards to a sort of moustache; teeth rasp-like, the external row strongest; three rays in the ventrals, which are directly under the pectorals. From the Indian Ocean.

*Zoarcus*. These cannot be separated from the Blennies, though they have no spinal ray, for they have all the more essential characters; [one species, *Z. viviparus*, is very common on the British shores, especially the north and east; it is easily taken about the season when charlock is in flower in the corn-fields; but it is of little value, and generally disliked, because when boiled its bones turn green. It attains the length of seven or eight inches, and the female brings forth her young alive. The body is heavy and lumbering, for so small a fish. *Z. labrous* is an American species, of an olive colour, with brown spots, and it sometimes attains the length of three feet.]

*Anarrichas*. [So very similar did Cuvier consider these fish to the Blennies, that he was disposed to consider them as Blennies without ventral fins.] Their dorsal fin is composed entirely of simple but not stiff rays, and extends, as does also the anal, very close to the base of the caudal, which last, as well as the pectorals, is rounded. The whole body is soft and slimy. Their parietal bones, vomer, and mandibles, are hard, with stout bony tubercles, surmounted by small enamel teeth; but their front



Fig. 141.—*Anarrichas lupus*.

teeth are much larger and conical. This structure of the teeth gives them an armature, which, added to their large size, makes them both fierce and dangerous fishes. They have six rays in the gills; stomach short and fleshy, with the pylorus near its base; the intestines short, wide, and without cæca; and they have no air bladder.

*A. lupus*, the Sea Wolf, or Sea Cat, is the most common species : it inhabits the north seas, and is very often met with ; attaining the length of six or seven feet. Its colour is brown, clouded with darker. Its flesh resembles that of an Eel. It is very valuable to the Icelanders, who salt its flesh for food, employ its skin as shagreen, and make use of its gall as soap. [This large and formidable species is almost exclusively confined to the northern seas, and in appearance it is a very repulsive fish. Its body is thick and lumbering, while the form



the first of which reaches backwards nearly to the tail; and the second dorsal and the anal have also the rays considerably elongated. They have neither cul-de-sac to the stomach, cæca, nor air-bladder.

One species, *C. lyra*, the Dragonet, is common in the British Channel, [and not rare on many parts of the British coast, even as far north as the Orkneys. The prevailing colour is yellow, with spots of brownish yellow, whence some of the common names of the fish. It frequents the shallow waters, feeding on Crustacea, Mollusca, and Worms; and answering little purpose, save as food for more valuable fish. Its flesh is said, however, to be firm and good. *C. dracunculus*, the Sordid Dragonet, is more dingy in colour, and has the rays of the first dorsal much less produced. It was once supposed to be the female of the other species, but the mistake has been found out and rectified. There are some subgenera nearly allied to *Callionymus*.]

*Trichonotus*, differs not much from the last, except in having the body very long, a single dorsal, and the anal proportionally longer. The first two rays of the dorsal are extended in long threads, representing the first dorsal of the former. It is said that the gill-openings of this subgenus are tolerably wide.

*Comphorus*, have the first dorsal very low; the muzzle oblong, depressed, and broad; the gills with seven rays, and large openings; the pectorals very long; and (which distinguishes them from the rest of the family) they have no ventrals whatever. The known species is found in the fresh-water lake of Baikal. It is a foot in length, very soft and greasy in its substance, and pressed for obtaining an oil. It is not fished for in the lake, but found dead on the shores after storms, which are there severe and frequent.

*Chirus*, are fishes with the body rather long, small ciliated scales, a small unarmed head, a shallow mouth, with small and irregular conical teeth. The spines of the dorsal are always slender, and that fin extends along the whole back. Their distinguishing character is several series of pores, extending along the side, and having some resemblance to additional lateral lines. All the known species inhabit the Sea of Kamtschatka.

### THE THIRTEENTH FAMILY OF THE ACANTHOPTERYGII.

#### PECTORALES PEDUNCULATI (Fishes with Wrists to the Pectoral Fins).

There are some spinous fishes in which the carpal bones are so elongated as to form a sort of arm or wrist, to the extremity of which the pectoral fin is articulated. The family consists of two genera, closely allied to each other, though authors have sometimes placed them far apart in their arrangements; and they are also related to the Gobies, [particularly to *Periophthalmus*, already noticed. This is a very peculiar structure of the fins; gives these fishes a strange appearance, and enables them, in some instances, to leap suddenly up in the water, and seize prey which they observe above them; and in others to leap over the mud, somewhat after the manner of Frogs.]

*Lophius*, Anglers.—The distinguishing character of these, besides their demi-cartilaginous skeleton, and their skin without scales, consists in the pectoral being supported as by two arms, each consisting of two bones, which may be compared to the radius and ulna of an arm, but which in reality belong to the carpus, or wrist; and in this genus they are larger than in any other. They are also characterized by having the ventrals placed much in advance of the pectorals; and by having the operculum and the gill-rays enveloped in the skin, so that the gill-opening is merely a hole situated behind the pectoral. They are voracious fishes, with a large stomach and a short intestine; and they can live a long time out of the water, in consequence of the small size of their gill-openings. They admit of division into three subgenera.

*Lophius*, head excessively large compared to the body; very broad, depressed, and spinous in many parts; the mouth deeply cleft, and armed with pointed teeth; and the lower jaw fringed round with many fleshy barbules. They have two dorsal fins, and some rays of the first are free, and move on the bones of the head, where they rest on a horizontal interspal process. [In the Angler, or Fishing Frog of the British seas, the motions of these detached rays are very peculiar. Two are considerably in advance of the eyes, almost close to the upper lip; the posterior of these is articulated by a stirrup upon a ridge of the base, but the anterior one is articulated by a ring at its base, into a solid staple of the bone, thus admitting of free motion in every direction, without the possibility of displacement, except in case of absolute fracture. The third one, which is on the top of the cranium behind the eyes, is articulated much in the same manner as the posterior one of the other two; and of course, though these two have considerable motion in the mesial plane of the fish, they have very little in the cross direction. The one near the lip, however, can be moved with nearly the same ease and rapidity in every direction; and while the others terminate in points, it carries a little membrane, or flag, of brilliant metallic lustre, which the fish is understood to use as a means of alluring its prey; and the position of the flag, the eyes, and the mouth, certainly would answer well for such a purpose]. The gill-membrane forms a large sac, opening in the axilla of the pectorals, supported by six very long rays, and with a small operculum. They have only three gills on each side. It is said that these fishes lurk in the mud, where, by agitating the rays on their heads, they attract smaller fishes, which mistake the appendages upon the rays for worms, and which are instantly seized, and transferred to the gill-sac. Their intestines have two or three short cæca near the commencement, but the fishes have no air-bladders.

*L. piscatorius*, the Fishing Frog, Sea Devil, and many other local names, attains sometimes the length of four or

five feet; and the extreme hideousness of its appearance has procured it some celebrity. [There are few parts of the muddy shores of the British islands where these ugly and voracious fish are not to be met with; and such is its propensity to keep its great mouth in exercise, that when captured in a net along with other fishes, it speedily begins to swallow its companions, especially if Flounders, which appear to be its favourite food. On some coasts, it is sought for on account of the live fish in its stomach, its own flesh being but small in quantity, and held in little estimation. Another European species, *L. palviparus*, has its second dorsal lower, and five vertebrae fewer in the spine.]

*Chironectes*. These have, like the last genera, free rays on the head, of which the first is small, and often terminating by a tuft; and those behind it are enlarged by a membrane, which is sometimes very broad, and at other times they are united into a fin. Their body and head are compressed, and their mouth opens vertically. Their gill membranes have four rays, and have no opening but a small hole behind the pectorals. Their dorsal extends along the whole back, and they often have cutaneous appendages all over their bodies. They have four gills, a large air-bladder, and a moderate intestine without cæca. They can inflate their great stomach with air, in the same manner as the Tetradons blow up their bellies like balloons. On the ground, their two pairs of fins enable them to crawl along like little quadrupeds; and the pectorals, in consequence of their position, perform the functions of hind legs. They can live out of the water for two or three days. They are found only in the seas of warm countries, and *Aænas* confounded many of them under the name *L. histrio*. [In some of the muddy estuaries on the north coast of Australia, from which the tide ebbs far back in the dry season, these Frog-fishes are so abundant, and capable of taking such vigorous leaps, that those who have visited the places have, at first sight, taken them for birds.] One might separate the species in which the second and third rays are united into a fin, and sometimes also joined to the other dorsals.

*Malthus*. These have the head greatly extended and flattened, principally by the projection of the sub-operculum; the eyes are forwards; the snout projecting, with a little horn; the mouth under the muzzle, of mean size, and protractile; the gills sustained by six or seven rays, and opening by a hole above each pectoral. They have a simple dorsal, which is soft and small; and there are no free rays in the head. The body is studded with osseous tubercles, and bordered round with cirri. They have neither cæca nor air-bladder.

The remaining genus of this family is *Batrachus*, the Frog-fishes, properly so called. They have the head flattened horizontally, and much larger than the body; the gape deeply cleft; the operculum and sub-operculum spinous; six gill-rays; the ventrals straight, attached under the throat, with only three rays, of which the first is broad and lengthened; the pectorals are carried by a short arm, resulting from an elongation of the carpal bones: their first dorsal is short, supported by three spinous rays; the second is soft and long, and has the anal corresponding to it; their lips are often garnished with filaments; their stomach is an oblong sac; their intestines are short, and without cæca; and their air-vessel is anteriorly deeply forked. They lurk in the sand, in order to swallow small fishes, in the same manner as the members of the last genus; and it is thought that wounds inflicted by their spines are dangerous. They inhabit both oceans. In some, the scales are smooth, and they have a membrane over the eye; others are scaly, and want that membrane. [None of them appear in the authenticated lists of British fishes.]

## THE FOURTEENTH FAMILY OF THE ACANTHOPTERYGII.

### LABRIDÆ (the WRASSE, or ROCK-FISH Family).

This family are easily known by their appearance. They have an oblong body, covered with scales; and a single dorsal, supported anteriorly by spinous rays, often furnished with membranous laminae. The jaws are covered by fleshy lips. There are three bones in the pharynx,—two upper ones attached to the cranium, and a large under one. All the three are furnished with teeth, arranged like a pavement in some, and pointed, or in laminae, in others; but generally stronger than is usual in the class of Fishes. Their intestinal canal is either without cæca, or with two small ones; and they have a large and strong air-bladder. They admit of division into various genera and subgenera.

*Labrus*, or Lipped—that is, Thick-lipped—Fishes. A very numerous genus, the species of which much resemble each other in their oblong form, and in their double fleshy lips, from which they receive their name. One of these lips adheres immediately to the jaw-bones, and the other to the suborbitals. They have thickly-set gills, with five rays. Their conical maxillary teeth (of which the middle and front ones are the largest), and their cylindrical teeth in the pharynx, are arranged like a pavement,—the upper ones with two large plates, and the under with one only, which fits to the others. Their stomach has no cul-de-sac, but is continued in an intestine without cæca, which, after two reduplications, terminates in a wide rectum. The air-bladder is single, and strong. There are several subgenera.

*Labrus*, properly so called, vulgarly termed "Old Wives of the Sea." They have no spines or notches in the operculum or pre-operculum, and the operculum and cheek are covered with scales. The lateral line is nearly straight. The European seas furnish several species, which, from variations of colour in the same species, are not easily distinguished from each other. *L. maculatus*, the Balloon Wrasse, is a foot or eighteen inches long, with twenty or twenty-one spines in the dorsal; blue or greenish above; white below; marked all over with yellow, and

the first of which reaches backwards nearly to the tail; and the second dorsal and the anal have also the rays considerably elongated. They have neither cul-de-sac to the stomach, cœca, nor air-bladder.

One species, *C. lyra*, the Dragonet, is common in the British Channel, [and not rare on many parts of the British coast, even as far north as the Orkneys. The prevailing colour is yellow, with spots of brownish yellow, whence some of the common names of the fish. It frequents the shallow waters, feeding on Crustacea, Mollusca, and Worms; and answering little purpose, save as food for more valuable fish. Its flesh is said, however, to be firm and good. *C. dracunculus*, the Sordid Dragonet, is more dingy in colour, and has the rays of the first dorsal much less produced. It was once supposed to be the female of the other species, but the mistake has been found out and rectified. There are some subgenera nearly allied to *Callionymus*.]

*Trichonotus*, differs not much from the last, except in having the body very long, a single dorsal, and the anal proportionally longer. The first two rays of the dorsal are extended in long threads, representing the first dorsal of the former. It is said that the gill-openings of this subgenus are tolerably wide.

*Comephorus*, have the first dorsal very low; the muzzle oblong, depressed, and broad; the gills with seven rays, and large openings; the pectorals very long; and (which distinguishes them from the rest of the family) they have no ventrals whatever. The known species is found in the fresh-water lake of Baikal. It is a foot in length, very soft and greasy in its substance, and pressed for obtaining an oil. It is not fished for in the lake, but found dead on the shores after storms, which are there severe and frequent.

*Chirus*, are fishes with the body rather long, small ciliated scales, a small unarmed head, a shallow mouth, with small and irregular conical teeth. The spines of the dorsal are always slender, and that fin extends along the whole back. Their distinguishing character is several series of pores, extending along the side, and having some resemblance to additional lateral lines. All the known species inhabit the Sea of Kamtschatka.

### THE THIRTEENTH FAMILY OF THE ACANTHOPTERYGII.

#### PECTORALES PEDUNCULATI (Fishes with Wrists to the Pectoral Fins).

There are some spinous fishes in which the carpal bones are so elongated as to form a sort of arm or wrist, to the extremity of which the pectoral fin is articulated. The family consists of two genera, closely allied to each other, though authors have sometimes placed them far apart in their arrangements; and they are also related to the Gobies, [particularly to *Periophthalmus*, already noticed. This is a very peculiar structure of the fins; gives these fishes a strange appearance, and enables them, in some instances, to leap suddenly up in the water, and seize prey which they observe above them; and in others to leap over the mud, somewhat after the manner of Frogs.]

*Lophius*, Anglers.—The distinguishing character of these, besides their demi-cartilaginous skeleton, and their skin without scales, consists in the pectoral being supported as by two arms, each consisting of two bones, which may be compared to the radius and ulna of an arm, but which in reality belong to the carpus, or wrist; and in this genus they are larger than in any other. They are also characterized by having the ventrals placed much in advance of the pectorals; and by having the operculum and the gill-rays enveloped in the skin, so that the gill-opening is merely a hole situated behind the pectoral. They are voracious fishes, with a large stomach and a short intestine; and they can live a long time out of the water, in consequence of the small size of their gill-openings. They admit of division into three subgenera.

*Lophius*, head excessively large compared to the body; very broad, depressed, and spinous in many parts; the mouth deeply cleft, and armed with pointed teeth; and the lower jaw fringed round with many fleshy barbules. They have two dorsal fins, and some rays of the first are free, and move on the bones of the head, where they rest on a horizontal interspinal process. [In the Angler, or Fishing Frog of the British seas, the motions of these detached rays are very peculiar. Two are considerably in advance of the eyes, almost close to the upper lip; the posterior of these is articulated by a stirrup upon a ridge of the base, but the anterior one is articulated by a ring at its base, into a solid staple of the bone, thus admitting of free motion in every direction, without the possibility of displacement, except in case of absolute fracture. The third one, which is on the top of the cranium behind the eyes, is articulated much in the same manner as the posterior one of the other two; and of course, though these two have considerable motion in the mesial plane of the fish, they have very little in the cross direction. The one near the lip, however, can be moved with nearly the same ease and rapidity in every direction; and while the others terminate in points, it carries a little membrane, or flag, of brilliant metallic lustre, which the fish is understood to use as a means of alluring its prey; and the position of the flag, the eyes, and the mouth, certainly would answer well for such a purpose]. The gill-membrane forms a large sac, opening in the axilla of the pectorals, supported by six very long rays, and with a small operculum. They have only three gills on each side. It is said that these fishes lurk in the mud, where, by agitating the rays on their heads, they attract smaller fishes, which mistake the appendages upon the rays for worms, and which are instantly seized, and transferred to the gill-sac. Their intestines have two or three short cœca near the commencement, but the fishes have no air-bladders.

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five feet; and the extreme hideousness of its appearance has procured it some celebrity. [There are few parts of the muddy shores of the British islands where these ugly and voracious fish are not to be met with; and such is its propensity to keep its great mouth in exercise, that when captured in a net along with other fishes, it speedily begins to swallow its companions, especially if Flounders, which appear to be its favourite food. On some coasts, it is sought for on account of the live fish in its stomach, its own flesh being but small in quantity, and held in little estimation. Another European species, *L. palviparus*, has its second dorsal lower, and five vertebrae fewer in the spine.

*Chironectes*. These have, like the last genera, free rays on the head, of which the first is small, and often terminating by a tuft; and those behind it are enlarged by a membrane, which is sometimes very broad, and at other times they are united into a fin. Their body and head are compressed, and their mouth opens vertically. Their gill membranes have four rays, and have no opening but a small hole behind the pectorals. Their dorsal extends along the whole back, and they often have cutaneous appendages all over their bodies. They have four gills, a large air-bladder, and a moderate intestine without cæca. They can inflate their great stomach with air, in the same manner as the Tetrodons blow up their bellies like balloons. On the ground, their two pairs of fins enable them to crawl along like little quadrupeds; and the pectorals, in consequence of their position, perform the functions of hind legs. They can live out of the water for two or three days. They are found only in the seas of warm countries, and Æneas confounded many of them under the name *L. histrio*. [In some of the muddy estuaries on the north coast of Australia, from which the tide ebbs far back in the dry season, these Frog-fishes are so abundant, and capable of taking such vigorous leaps, that those who have visited the places have, at first sight, taken them for birds.] One might separate the species in which the second and third rays are united into a fin, and sometimes also joined to the other dorsals.

*Malitus*. These have the head greatly extended and flattened, principally by the projection of the sub-operculum; the eyes are forwards; the snout projecting, with a little horn; the mouth under the muzzle, of mean size, and protractile; the gills sustained by six or seven rays, and opening by a hole above each pectoral. They have a simple dorsal, which is soft and small; and there are no free rays in the head. The body is studded with osseous tubercles, and bordered round with cirri. They have neither cæca nor air-bladder.

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## THE FOURTEENTH FAMILY OF THE ACANTHOPTERYGII.

### LABRIDÆ (the Wrasse, or Rock-fish Family).

This family are easily known by their appearance. They have an oblong body, covered with scales; and a single dorsal, supported anteriorly by spinous rays, often furnished with membranous laminae. The jaws are covered by fleshy lips. There are three bones in the pharynx,—two upper ones attached to the cranium, and a large under one. All the three are furnished with teeth, arranged like a pavement in some, and pointed, or in laminae, in others; but generally stronger than is usual in the class of Fishes. Their intestinal canal is either without cæca, or with two small ones; and they have a large and strong air-bladder. They admit of division into various genera and subgenera.

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*Labrus*, properly so called, vulgarly termed "Old Wives of the Sea." They have no spines or notches in the operculum or pre-operculum, and the operculum and cheek are covered with scales. The lateral line is nearly straight. The European seas furnish several species, which, from variations of colour in the same species, are not easily distinguished from each other. *L. maculatus*, the Balloon Wrasse, is a foot or eighteen inches long, with twenty or twenty-one spines in the dorsal; blue or greenish above; white below; marked all over with yellow, and

sometimes the yellow colour predominates. [This species is numerous upon the British shores, though they are not very often caught; and from the variations of their colours they are not easily identified. They frequent deep pools among the rocks, hide themselves in fuci, and are understood to feed chiefly on Crustacea. If the fishermen know their haunts, they take a bait freely; and, according to the report of Mr. Couch, the first taken are always the largest. They frequent the rocky shores only. They spawn in April; and the fry, which are then of small size, remain among the rocks during the summer. It is understood that the blue colour, which appears to be characteristic of the high condition of the fish, is very evanescent. *L. lineatus*, the Lineal-streaked, is more clouded; has irregular bands along the flank, the ground of which is reddish; and the dorsal spines are less numerous, and the soft part of the fin lower, than in the former species. This species is named as a British fish, but it appears to be exceedingly rare. *L. variegatus*, the Blue-streaked, is one of the most beautiful of the family, of an orange red, paler on the belly, having the sides and irides striped with fine blue. The lips are capable of great extension, and there is a single row of pointed teeth in each jaw. It is found in the British seas, but only on the south and south-west coasts. *L. vetula*, is also named as a British fish. It is dark purple, black on the upper part, paler on the belly, and has the fore part of the head flesh-coloured, tinged with purple, and the eyelid blue. Few specimens have been met with on the British shores, and those of comparatively small size. Perhaps it is the *Merula* of Gmelin. *L. carneus*, the Three-spotted Wrasse, reddish in the colour, with four light spots, and three black ones intermediate, extending from the middle of the dorsal to the root of the caudal. It belongs to the Mediterranean, but has been found on the Channel-coast of England, in the Firth of Forth, and even on the coast of Norway, and in the Baltic. There are various other species; but, as we have said, they are not easily distinguished from each other, in consequence of the change of colour to which they are subject.]

*Cheilinus*, differs from *Labrus*, properly so called, in having the lateral line interrupted at the end of the dorsals, where it recommences a little lower down. They are beautiful fishes, inhabiting the Indian seas.

*Lachnolaimus*, (Captains), have the general character of *Labrus*; but their pharynx has no pavement-like teeth, except in the posterior part,—the remainder of them, as well as a part of the palate, being covered with a villous membrane. They are easily known by the first spines of the dorsal, which extend in long flexible threads. They are American fishes.

*Julis*, have the head entirely without scales, and the lateral line forming a curve near the end of the dorsal. There are some in the Mediterranean, but they are more numerous in the tropical seas. [They are generally small but beautiful fishes: some are violet, some bright scarlet, some rich green, and some marked with golden colour; and those which have the caudal fin rounded, or truncated, have the first dorsal rays extended in long filaments.]

*Anampses*, have the character of the last, with the exception of two flat teeth, which project from the mouth, and curve upwards. The two known species are from the Indian seas.

*Crenilabrus*. These fishes are separated from the *Lutjanus* of Bloch, to arrange them in their proper place. They have the true characters of *Labrus*, both external and internal; and differ only in having the border of the pre-operculum toothed. Some species are found in the North Sea, such as *Lutjanus ruppellii* of Bloch, yellow, with clouded bands ranged vertically, and blackish; *L. norvegicus*, brownish, irregularly marked with deep brown; *L. melope*, orange, spotted with blue, and a black spot behind the eye; *L. exoletus*, remarkable for five spines in the anal fin. The Mediterranean furnishes a number, most beautifully coloured, the most splendid of which is *L. lapina*, silvery, with three broad longitudinal bands, composed of vermillion dots, with the pectorals yellow and the ventrals blue. They are also abundant in the tropical seas; and many species, hitherto included in the genus *Labrus*, ought to be placed here. [Several species of this subgenus occur in the British seas, the chief of which are—*Crenilabrus tinca*, the Gilt-head; *C. corneticus*, the Gold-sinny; *C. gibbus*, the Gibbous Wrasse; and *C. leusias*, the Scale-rayed Wrasse; but they are all small fishes, in little or no estimation.]

*Coriscus*. This subgenus has all the characters of the last, in addition to which the mouth is little less protractile than in the next. Only one small species is known, which inhabits the Mediterranean. This genus is removed from *Sparus*, in order to be placed near the preceding ones.

*Epibulus*. These fishes are remarkable for the extreme extension which they can give to their mouth by means of a see-saw motion of their maxillaries, and the sliding forward of the intermaxillaries, which instantly forms a kind of tube. They make use of this artifice for seizing small fishes which pass near this curious instrument; and the same artifice is resorted to by the Coryci, the Zei, and the Smares, according to the degree of protractility of the mouth. The entire body and head of this subgenus are covered with large scales, the last track of which advances upon the anal and caudal fins, as in *Cheilinus*. The lateral line is similarly interrupted as in the latter; and, as in *Labrus*, there are two long conical teeth in the front of each jaw, followed by smaller blunt ones. The known species is from the Indian seas, and is of a reddish colour.

*Clepticus*. This subgenus has a small cylindrical snout, which is suddenly advanced forward, but which is not so long as the head. The teeth are small, and barely perceptible to the touch; the body is oblong; the lateral line continuous; and the dorsal and anal are enveloped in scales nearly to the top of the spines. One species, of a red colour, and from the West Indies, is the only one known.

*Gomphosus*. These Labridæ, with the head entirely smooth, as in *Julis*, have the muzzle in the form of a tube, composed of the prolonged maxillaries and intermaxillaries, as far as the small opening of the mouth. Several species are taken in the Indian Ocean, and the flesh of some is considered delicious.

*Xirichthys*, resemble *Labrus* in their general form, but are much compressed. The forehead descends towards the mouth with a sharp and almost vertical line, formed by the ethmoid and the ascending branches of the intermaxillaries. Their bodies have large scales; their lateral line is interrupted; their jaws are furnished with conical

teeth, largest in the centre; the pharynx is paved with hemispherical teeth; the intestinal canal has two flexures, but no cœca; the stomach has no cul-de-sac, and they have a tolerably long air-bladder. [Until Cuvier arranged them differently, they were always classed with the Coryphenes, from which they differ much, both externally and internally.] They most nearly resemble Labrus, and are not easily distinguished from it, except by the profile of the head. Are found in the Mediterranean, and also in the southern seas; and the flesh of some is much esteemed.

*Chromis*. These have the lips, protractile maxillaries, pharyngeals, and general aspect of Labrus; but their teeth resemble those of a card, except a range of conical ones in front. Their dorsal fins have long filaments; their ventrals are produced into long threads; their lateral line is interrupted; and their stomach forms a cul-de-sac, but has no cœca. A small one, of a chestnut-brown colour, is taken in vast numbers in the Mediterranean; and there is one in the Nile, *C. niloticus*, the Egyptian *Corycina* of the ancients, which attains the length of two feet, and is reckoned the best fish in Egypt.

*Cyckia*, have the teeth small and crowded, formed into a large band, and the body elongated, which are their chief differences from the preceding subgenus.

*Plesiops*, have the head compressed, the eyes near each other, and extremely long ventrals; but in other respects they resemble *Chromis*.

*Malacanthus*. These have the general character of Labrus, and the same teeth in the maxillaries, but their teeth in the pharynx are arranged like those of a card. Their bodies are elongated, their lateral line continuous, their operculum terminated by a small spine, and their long dorsal has only a few flexible spinous rays in the fleshy part. A species is found in the West Indies, of a yellowish colour, irregularly streaked across with violet, which, like many others belonging to this family, has been improperly ranged with the Coryphenes.

*Scarus*.—The fishes of this genus are remarkable for their jaws—that is to say, for their intermaxillaries and premandibles,—which are convex, rounded, and furnished with scale-like teeth on their margin and anterior surface. These teeth succeed each other from the rear to the front in such a manner that the bases of the newest form a trenchant range. It has been erroneously supposed by naturalists that the bone in this state is naked. In the living state, the jaws are covered with fleshy lips, but there is no double lip adhering to the suborbital bones. These fishes have the oblong form of Labrus, with large scales, and an interrupted lateral line. They have two plates in the upper part of their pharynx, and one in the under, furnished with teeth as in Labrus; but their teeth are in transverse laminae, and not rounded and arranged like the stones of a pavement.

The Archipelago contains one species, of a blue or red colour, according to the season, which is the *S. creticus* of Aldrovandus; and which, after new investigations, I believe is the true *Scarus* so celebrated among the ancients, which, during the reign of Claudius, Elipertius Optatus the Roman admiral sailed to Greece in order to obtain and distribute through the Italian seas. It is still eaten in Greece, and its intestines are used for seasoning. There are numerous species in the tropical seas, which, on account of the form of their jaws and the brilliancy of their colours, are called Parrot-fishes. Some have the caudal fin in the shape of a crescent; and of these a few have the front singularly enlarged and rounded, while in others it is truncated to a square. These constitute the genus *Scarus*, properly so called, from which two subgenera may be separated:—*Calliodon*, which have the lateral teeth of the upper jaw separate and pointed, and on the same jaw an anterior range, much smaller in size; and *Odax*, which resemble the true Labrus in their thickened lips and uninterrupted lateral line, but their jaws are constructed as in *Scarus*, except that the bones are flat, not rounded, and are covered by the lips. Their teeth, however, resemble pavement, like those of Labrus.

## THE FIFTEENTH FAMILY OF THE ACANTHOPTERYGII.

### FISTULARIDÆ (Pipe-mouthed Fishes).

The fishes of this family are characterized by a long tube projected forwards from the cranium, and composed of elongations of the ethmoid, vomer, pre-operculum, inter-operculum, pterygoids, and tympanals, at the extremity of which they have the mouth, composed, as usual, of intermaxillaries, maxillaries, palatals, and mandibles. Their intestine has no great inequalities, nor many flexures; and their ribs are short, or wanting. The family consists of two genera:—*Fistularia*, with the bodies cylindrical; and *Centricus*, in which it is oval and compressed.

*Fistularia*. Fishes of this genus receive their particular name from the long tube common to all the family. Their jaws are at its extremity, but little cleft, and opening nearly in a horizontal direction. Their head, thus elongated, is equal to a third or a fourth of the length of the body, which is itself long and slender. There are six or seven rays in their gills; and some osseous appendages extending behind the head, by means of which the anterior part of the body is more or less strengthened. The dorsal is directly above the anal; and the stomach is a fleshy tube extending in a straight canal, but with two cœca at the commencement. There are two subgenera.

*Fistularia*, Pipe-mouths, properly so called. These have only one dorsal, consisting, in great part, as well as the anal, of simple rays. Their intermaxillaries and the lower jaw are furnished with small teeth. From between the lobes of the caudal fin there arises a sort of filament, which is sometimes as long as the body. The tube of the muzzle is depressed; the air-bladder is exceedingly small; and the scales on the skin are invisible. They are found in the warm seas of both hemispheres. [Sailors term them Tobacco-pipe Fishes, and they are of no value, except as curiosities.]

*Aulostomus*. These have numerous free spines before the dorsal; and their jaws are toothless: their body is very scaly; not so slender as in the former subgenus, but enlarged and compressed between the dorsal and the anal, which enlargement is followed by a short and slender tail, ending in a common fin. The tube of the muzzle is shorter, wider, and much more compressed than that of the true Pipe Fishes; and the air-bladder is larger. There is but a single known species, which is a native of the Indian Ocean.

*Centriscus*, or Snipe-fish.—These have the tubular muzzle characteristic of the family; but the body is oval or oblong, not lengthened, compressed laterally, and sharp on the upper part. They have only two or three slender gill-rays; a spinous first dorsal; and small ventrals behind the pectorals. Their mouth is very small, and opens obliquely: their intestine has two or three folds, but no cæca; and their air-bladder is of considerable size. As in *Fistularia*, they admit of division into two subgenera.

*Centriscus*, properly so called. These have the first dorsal fin backwards; and the first dorsal spine, which is long and strong, connected, by intermediate pieces, with the bones of the shoulder and the head. They have the body covered with small scales, and some larger denticulated ones over the apparatus connected with the spinous ray of the first dorsal. [This ray is strong in itself, firmly supported, and with rugged teeth on its posterior edge, capable of being moved, and thus forms a very powerful weapon. One species, *C. scolopax*, the Sea Snipe, Sea Trumpet, or Bellows Fish of the Cornish coast, is common in the Mediterranean, and is occasionally found on the south coast as a straggler. The specimens met with are not large, not exceeding five or six inches in length. The young are of a brilliant silvery lustre; but when mature, the back is red, paler on the sides, and passing into silvery, glossed with gold, on the belly. All the fins are greyish white. The scales are hard and rough, granulated on the surface, and beautifully ciliated on the posterior edge. Its flesh is considered good. Its haunts are understood to be muddy bottoms, in moderately deep water; and its food the minute Crustacea with which such places usually abound.]

*Amphile*, has the back mailed with large scaly pieces, of which the anterior spine of the first dorsal appears to be a continuation. Some have other scaly pieces on the flanks, and the spine in question placed so far behind that it is against the base of the tail; against which it, as it were, thrusts the second dorsal and the anal; this is *C. scutatus*. Others are intermediate between this form and that of the ordinary *Centriscus*, or have the mail plates covering only a part of the back; such is *C. velitaris*. All the known species are inhabitants of the Indian seas.

## THE SECOND ORDER OF BONY FISHES.

### MALACOPTERYGII ABDOMINALES.

The second division of the Ordinary Fishes, [or fishes with bones in the skeleton,] the *Malacopterygii*, or Jointed-fin Fishes, consists of three orders, the distinguishing character of each of which is the position or absence of the ventral fins.

The present order comprises fishes which have the ventral fins suspended to the abdomen, behind the pectorals, without being attached to the bones of the shoulder; they are the most numerous order of the division, and include the greater part of fresh-water fishes. They are divided into five families.

### THE FIRST FAMILY OF THE MALACOPTERYGII ABDOMINALES.

#### CYPRINIDÆ (the CARP Family).

These have the mouth shallow, the jaws feeble, very often without teeth, and the margin formed by the outer maxillaries; but they have the pharynx strongly toothed, which compensates for the feeble armature of the jaws. They have few gill-rays; their body is scaly; and they have no adipose dorsal, as we shall find in the Silures and Salmon. The stomach has no cul-de-sac or cæcal appendages; and they are the least carnivorous of all fishes. [The genera and subgenera are arranged as follows:]—



*Cyprinus*.—These form a genus, at once very natural and very numerous; easily distinguished by the small mouth, the jaws without a single tooth, and three flat gill-rays. Their tongue is smooth; their palate furnished with a thick, soft, and remarkably sentient substance, vulgarly called carp's tongue. Their pharynx is a powerful instrument of mastication, having strong teeth on the inferior pharyngeal bones, and they bruise their aliments between these and a stony disc, which is set in a large cavity under a process of the sphenoid. They have but one dorsal; their body is covered with scales, usually large: they inhabit the fresh waters; and are the least carnivorous of fishes,—feeding chiefly on seeds, the roots of plants, and [as is said] on mud and sludge. The stomach is continuous, with a short intestine without cæcæ, and the air-bladder is divided in two by a close contraction. The genus is divided into the following subgenera:—

*Cyprinus*, the true Carps, have a long dorsal, of which, as well as the anal, the second ray has a spine more or less stout. Some of them have fleshy tubercles at the angles of the upper jaw, such as *C. carpio*, the Common Carp, a well-known fish: olive green above, and yellowish below; with strong toothed spines in the dorsal and anal, and short tubercles. The teeth of the pharynx are flat and striated in their crowns, [something like those of the Ruminant Mammalia]. Originally [as is understood] from the middle latitudes of Europe, it is now generally distributed, and thrives well in fish-ponds and other still waters, where it sometimes grows to the length of four feet: its flesh is esteemed as food. [Though an imported fish, Carp thrives well in England, though better in ponds than even in the most slow running parts of rivers; but in Scotland the waters are less adapted for them, and they breed and grow slowly, even in ponds. Austria and Prussia are the great Carp countries. To their vegetable food they add insects and worms, if such can be obtained: and when out of the water, they are very tenacious of life, in consequence of which they are easily extended from pond to pond.]

Of the true Carps there is one race, *C. rex carporum*, the King of the Carps, which have the scales large, but often wanting in patches, and sometimes entirely. They are artificially varied,—that is, they occur only in ponds. Some foreign species are reddish brown, and others golden green, but these are imperfectly known.

Some species want the barbules. Among these are,—*C. carassius*, having the body high, the lateral line straight, and the caudal fin squared off. This is a northern species. *C. gibelio*, the Crucian or Prussian Carp, has the body less elevated, the lateral line curved downwards, and tail fin forked. [It occurs as a British fish, but, perhaps, not so plentifully as the former]. *C. auratus*, the Golden Carp, [called Gold Fishes or Silver Fishes, according to their colour]. These are black when young, but by degrees acquire the golden red for which they are esteemed; though some of them are silvery, with various clouds of all the three colours. Some have no dorsal; others a very small one; others, again, a large caudal of three or four lobes; and others, still, very large eyes; all of which varieties are merely accidental, and the results of that artificial treatment which they receive when kept in glass vessels for ornamental purposes.

Allied to these is the smallest of the European Carps, *C. amarus*, only about an inch in length; greenish above, pale yellow beneath, with a steel-blue line on each side of the tail, in April, which is the spawning season.

*Barbus*, the Barbel, or Bearded Fish—from the cirri at its mouth—has the dorsal and anal short; a strong spine for the second or third dorsal ray; two cirri at the point of the muzzle, and two at the angles of the upper jaw. [*B. communis*,] the Common Barbel, known by its long head, is very common in streams and fish-ponds, and sometimes grows to the length of ten feet. [In the sluggish parts of the Thames, and some of its affluents, Barbel are very plentiful. They are said to plough up the mud with their noses, which, setting very small animals adrift in the water, attracts those small fishes on which the Barbel feeds.]

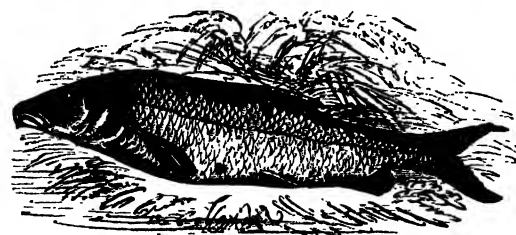


Fig. 142.—The Barbel.

*Gobio*, the Gudgeons, have the dorsal and anal short, and are without spines or beards. In slow-running rivers, where there is a gravelly interruption, they are found in vast shoals, readily caught, and, though small in size, esteemed for their flavour.

*Tinca*, the Tenches, resembling the Gudgeons, but have the scales and cirri very small. The Common Tench is short and thick, of a yellowish brown, and sometimes beautifully golden. It prefers stagnant waters, and is not in much estimation as food.

*Citrhinus*, have the dorsal larger than the Gudgeons, and the cirri in the central part of the upper lip.

*Abramis*, Bream, have neither spines nor cirri; a short dorsal behind the ventrals, or long anal; and the tail forked. There are two species, the Carp Bream, and the White Bream; the first is the largest and most highly esteemed; and the other is of little value, except to feed other fishes in ponds.

*Labeo*. All foreigners; have neither spines nor cirri along the dorsal, and remarkably thick lips, often furred.

*Catostomus*, have the lips of the former, but a short dorsal above the ventrals. They are from North America.

*Leuciscus*: dorsal and anal short; no spines, cirri, or peculiarities of the lips: species numerous, but little esteemed. [One species, the Ide, *L. idus*, has been seen as a British fish; and besides this there are several others, as *L. dobulus*, the Double Roach; *L. utilis*, the Roach; *L. vulgaris*; *L. Lancasteriensis*, the Graining;



*L. cephalus*; *L. erythrophthalmus*, the Red Eye; *L. ceruleus*, the Azurine; *L. alburnus*, the Bleak; and *L. phoxinus*, the Minnow; but none of them are fishes of any great importance, except as bait for more valuable ones.]

*Gonorhynchus*, have the head and body elongated, the operculum covered with small scales, the muzzle angular, the small mouth without teeth or cirri, three gill-rays, and a small dorsal over the ventrals. Known only in Southern Africa.

*Cobitis*, Loche, or Loach, have the head small; the body long, covered with small scales, and slimy; the ventral fins are far backwards, and above them there is a single dorsal; the mouth is at the end of the muzzle, little cleft, and without teeth, but having lips forming a sucker, and numerous barbules; the gills have small openings, and only three rays; the lower bones of the pharynx are strongly toothed; no cæca to their intestines, and these are very small; their two-lobed air-bladder is inclosed in a case of bone, adhering to the third and fourth vertebræ. There are three species in the fresh waters of Europe. *C. barbatula*, the Common Loach, or Beardie, is a little fish of four or five inches long, clouded, dotted with brown on a yellow ground, and having six barbules at the mouth. It is not uncommon in the shallow and clear-running streams; but on account of its lurking habits, the rapidity of its swimming when disturbed, and its small size, it is not often seen. Small as it is, its flesh is very good. *C. fossilis*, the Pond Loach, is sometimes a foot long, with longitudinal stripes of brown and yellow, and ten barbules to the mouth. They inhabit the mud of stagnant waters; and can subsist for a long time after the water has been dried up, or covered with ice. When the weather is stormy, they rise to the surface of the water, and keep it in a state of agitation by their motion; and when cold, they bury themselves in the mud. Ehrman states that they habitually swallow atmospheric air, which is discharged by the vent, after being changed into carbonic acid,—[a fact which is contrary to the usual physiology of the class]. Their flesh is soft, and has a muddy flavour. *C. taenia*, the Groundling, has six barbules, and the body compressed, of an orange colour, marked with a row of black spots. It has a large spine behind each nostril. It is the smallest of the species inhabiting the smaller running waters, and lurking under stones. [It is found in the British rivers, and is probably much more numerous than is generally represented; but as it is of no value, it is regarded only by naturalists.]

*Anableps*. This genus, long, but very improperly, united with *Cobitis*, has strong peculiar characters. The eyes are prominent, placed under a sort of roof formed by the side of the frontal; and the cornea and iris are divided by transverse bands, which gives the fish the appearance of having four eyes, whereas in reality it has only two. There are certainly two openings to each eye, but still, in its essential parts, the organ is single; and whether vision is performed by the anterior or posterior opening, the same sentient organ is acted upon. They have also the generative and urinal aperture, in the male, placed before the vent; and the female brings forth her young alive, and in a state of considerable advancement. The body is cylindrical, with strong scales; there are five gill-rays; the head is flat; the snout blunt, and the mouth across its extremity, with small crowded teeth in both jaws; the intermaxillaries have no peduncle, but are suspended to the nasal bones; the pectorals are in part scaly; the dorsal is small, and nearer the tail than the anal; the pharyngals are large, and covered with small globular teeth; the air-bladder is large; and their intestine is wide, but without any cæca. Only one species, *A. tetraphthalmus*, the Four-eyed, is known. It inhabits the rivers of Guiana.

*Poecilia*. These have the jaws horizontally flattened, with a small opening, and furnished with a single row of small and very fine teeth; the upper part of the head flat; the gill-openings large, with five gill-rays; the body rather short; the ventrals rather forward; and the dorsal and anal against each other. They are small fishes of the fresh waters of America, and bring forth their young alive.

*Labias*, resemble the preceding, only the teeth have several points. One species, a very small fish, with little black streaks on the flanks, is found in Sardinia.

\* *Fungulus*, still resemble *Poecilia*, but their teeth are set like velvet: those in the anterior range are crooked, and they have strong conical ones in the pharynx. They have only four gill-rays.

*Molenezia*, have the anal between the ventrals, and immediately under the anterior part of the large dorsal; teeth like *Fungulus*, and four or five gill-rays. [These genera are chiefly found in America.]

*Cyprinodon*, have fine velvety teeth, and six gill-rays, but in other respects are like the preceding genera. *C. umbra* inhabits the lakes, and especially the subterranean waters which are so common in Southern Austria. They are small fishes, of a russet colour, with brown spots.

## THE SECOND FAMILY OF THE MALACOPTERYGII ABDOMINALES.

### ESOCIDÆ (the PIKE Family).

These have no adipose dorsal fin. The margin of the upper jaw is formed by the intermaxillary; or when not so formed, the maxillary is toothless, and concealed by the lips. These fishes are extremely voracious; their intestine is short, and has no cæca; all of them have an air-bladder. Many species inhabit the fresh waters, or ascend rivers. With the exception of *Microstoma*, all the known ones have the dorsal opposite the anal. Linnæus included them all in the genus *Esox*, but we divide that genus into the following subgenera:—

*Esox*, Pikes properly so called, have small intermaxillaries, furnished with small pointed teeth in the middle of the upper jaw, where they form two rows, but the lateral parts of the maxillaries are without teeth. The vomer, the palatals, the tongue, the pharynx, and the gill-arches, are roughened with teeth like a card; and they have, in

the sides of the under-jaw, a row of long and pointed teeth. The muzzle is oblong, obtuse, broad, and depressed. They have but one dorsal placed over the anal; a large forward stomach, continued in a slender intestine with two flexures, but without cæca; and their air-bladder is very large.

*E. lucius*, the Common Pike, Jack, Pickarel, Gedd, and many other names, is well known to every one as the most voracious and destructive of fishes, but its flesh is good, and easy of digestion. [Besides its fame, as an eater and as being eaten, Shakspeare has thrown a ray of glory around the Pike by representing it as the "White Lucie" in the armorial bearings of the immortal Justice Shallow. In some of the still waters of Britain, Pike of thirty-four pounds' weight have been killed. It is generally said that, notwithstanding the havoc which the Pike commits among smaller fishes, it will not stand the attack of a Trout of equal weight, the immense velocity of the latter fish in swimming giving it a decided advantage]. Besides this, two species have been noticed in the fresh waters of North America,—*E. reticularis*, with a net-work of brownish lines; and *E. esox*, sprinkled with round blackish spots.

*Galaxius*, have no visible scales on the body. The opening of the mouth is small, with middle-sized pointed teeth in both jaws, the margin of the upper being formed by the intermaxillary, and a few strong crooked teeth on the tongue. There are pores in the sides of the head; and the position of the dorsal and anal fins, and also the digestive organs, are like those of the Pikes.

*Alepocephalus*. Head naked, body with broad scales, mouth small, teeth minute and crowded, eyes very large, and eight gill-rays. *A. rostratus*, the only known species, is found in the depths of the Mediterranean.

*Microstoma*. Snout very short, lower jaw beyond the upper, jaws and intermaxillaries with very small teeth, three broad and flat gill-rays, eyes large, body long, lateral line with firm scales, a single dorsal a little in rear of the ventrals, and digestive organs as in the Pike. The only known species (*S. microstoma* of Risso) inhabits the Mediterranean.

*Stomias*. Snout extremely short, mouth cleft almost to the gills, gill-ray reduced to a little membranous lamina, and maxillaries fixed in the cheek; intermaxillaries, palatals, mandibles, and tongue, armed with long and crooked teeth, widely set; body elongated; ventrals far back; dorsal over the anal, and both near the caudal. Two species were discovered in the Mediterranean by Risso. Both are black, with rows of silvery spots on the belly. *E. boe*, Risso, has no cirri; *S. barbatus*, has a long and stout one, attached to the symphysis of the lower jaw.

*Chauliodus*, resemble the former, but have two teeth in each jaw, across the other jaw when the mouth is shut; the dorsal between the pectorals and ventrals, which last are not so far back as in *Stomias*; the first dorsal ray terminates in a filament. *C. Sloani*, the only known species, has been found only at Gibraltar. It is about a foot and a half long, and of a deep green colour.

*Salanx*, have the head depressed, gill-lids folded downwards, and four flat gill-rays; the jaws short and pointed, each furnished with a row of crooked teeth; the upper jaw formed entirely by intermaxillaries without peduncles; the lower jaw is a little lengthened at the symphysis by a small appendage carrying the teeth; the palate and the inner part of the mouth are entirely smooth, and there is not even a lingual projection.

*Belone*. This genus have the upper jaw—which, as well as the under one, is extended into a long beak—composed of the intermaxillaries, and both jaws furnished with small teeth, without any others in the mouth, except in the pharynx, where they are arranged like a pavement. The body is very long, and covered with scales which are scarcely visible, except one keeled row on each side, near the under edge of the fish. They are remarkable for the bright green colour of their bones. One species—the Common Gar-fish, Sea Pike, Mackerel Guide, Green-bone, and a number of other names—is not uncommon on some parts of the British shores, and as far north as the Arctic regions. It is of a greenish blue on the upper part, fading gradually into silvery white on the belly. There are several other species, some of which are said to attain the length of eight feet, and bite very severely. Notwithstanding the colour of the bones, which renders them repulsive to many persons, the flesh of these fishes is not unwholesome.

*Scomberesox*, the Mackerel Pike, or Saury Pike, resembles the former in the length of its snout, its general shape, and its scales; but the last rays of the dorsal and anal are detached, and form spurious fins on the upper and under sides, like those of the Mackerel. They are found in the Mediterranean; [and the Common Saury is generally distributed along the British coasts, as far to the northward as the Orkneys]. They are gregarious fishes; and are followed and preyed upon by Porpoises, and also by the Tunny, and other large members of the Mackerel family.

*Hemiramphus*, resembles the Gar-fish in its general characters, but has the upper jaw short, and the lower one drawn out into a long beak, without teeth. They are found chiefly in the seas of warm countries, though a stray one is occasionally met with in the south of England.

*Ecoetetus*, [literally, "Fishes out of the water"]. These are at once distinguished from all the rest of the Abdominal Malacopterygii by the immense size of their pectoral fins, which are sufficiently large for supporting them for a few moments in the air. Their head and body are scaly, with a line of keeled scales along each flank; their head is flat above, and laterally; the dorsal over the anal; the eye is large; the intermaxillaries without peduncles,

and their swimming and flying enemies, they furnish one of the most singular sights in the warm seas. *E. exilens*, common in the Mediterranean, has the ventral fins long, and in rear of the middle of the body. *E. volitans*, common in the Atlantic, has the ventral fins small, and placed further forwards. The latter species sometimes visits the British shores, in single individuals, and even in shoals. They can leap more than two hundred yards in distance, and upwards of twenty feet in height. Their food is understood to be the small floating Mollusca; and themselves are good eating.

Next to the Pike family, there is placed a genus of fishes which, though differing but little from that family in other respects, has longer intestines, and two cæca. It will probably give rise to a new family. This is *Mormyrus*, having the body compressed, oblong, and scaly; tail thin at the base, but swelling near the fin; skin of the head naked, covering the operculum and gill-rays, and leaving no opening for the latter but a vertical fissure, which has led some naturalists to assert that these fishes have no gill-lids, and only one gill-ray, whereas their gill-lids are perfect, and their rays five or six. Their gape is small, and resembles that of the Ant-eater, the angles being formed by the maxillaries. The teeth are small, notched at the extremities, and occupy the intermaxillaries and lower jaw; and there are bands of small crowded ones on the vomer and tongue. The stomach is a roundish sac, followed by a slender intestine with two cæca, almost always covered with fat; and the air-bladder is long, large, and simple. They are accounted among the best fishes of the Nile. Two species have a cylindrical muzzle,—the one having a long dorsal, and the other a short one; a third has both the snout and dorsal short; and in a fourth, the forehead forms a protuberance advancing in front of the mouth. There are various other species in the Nile [and probably also in the other African rivers], but they have not been described.

### THE THIRD FAMILY OF THE MALACOPTERYGII ABDOMINALES.

#### SILURIDÆ (the SHEAT-FISH Family.)

These fishes are distinguished from all the rest of the order by the want of true scales, having only a naked skin, or large bony plates. The intermaxillaries, suspended under the ethmoid, form the margin of the upper jaw; and the maxillary bones are either simple vestiges, or extended into cirri. The intestinal canal is large, folded, and without cæca. The air-bladder is large, and adheres to a peculiar apparatus of bones. A strong articulated spine generally forms the first ray of the dorsal and the pectorals; and there is sometimes an adipose dorsal behind the other, as in the Salmon family. The following are the genera and subgenera:—

*Silurus*.—These form a numerous genus, known by the naked skin, from the mouth being cleft in the end of the muzzle, and from a strong spine in the first ray of the dorsal. This spine is articulated only to the bones of the shoulder; and the fish can at pleasure lay it flat on the body, or keep it fixed in a perpendicular direction, in which case it is a formidable weapon, and wounds inflicted by it are understood to be poisoned, which opinion has arisen from tetanus sometimes following the wound, not from poison certainly, but from the ragged nature of the wound itself.

These fishes have the head depressed; the intermaxillaries suspended under the ethmoid, and not protractile; the maxillaries very small, but almost always continued in barbules attached to the lower lip, and also to the nostrils; the covering of their gills is without sub-operculum or gill-flap; their air-bladder, strong and heart-shaped, is attached, by its two upper lobes, to a peculiar bony structure, which again is attached to the first vertebra; the stomach is a fleshy cul-de-sac, having the intestinal canal long and wide, but without cæca. They abound in the rivers of warm countries; and seeds of plants are found in the stomach of many of their species. The following are the subgenera:—

*Silurus*, properly so called, with only a small fin of four rays on the fore part of the back, but with the anal very long, and approaching very close to the base of the caudal. There is no obvious spine in the dorsal; and the teeth in both jaws, and in the vomer, are like those of a card. *S. glanis*, the Sly Silurus, is the largest fresh-water fish of Europe, and the only member of the genus in this quarter of the world. It is smooth, of a greenish black spotted with black above, and yellowish white below; head large, with six cirri,—two large ones near the nostrils, and four shorter on the lower jaw. It sometimes grows to six feet in length, and weighs three hundred pounds. It is found in the slow-running rivers of Central Europe, and lurks in the mud to watch for its prey. Its flesh is greasy, and is sometimes employed as hog's-lard. [It is named as a British fish, but its visits to these shores are very rare.] Is found in the rivers of Asia and Africa.

*Schilbus*, have the body vertically compressed, a strong toothed spine in the dorsal, the head small and depressed, the nape suddenly raised, and the eyes low down. They have eight cirri, are found in the Nile, and their flesh is

less disagreeable than that of the other Siluri. Some American species, with the head small, rounded, and blunt, having three cirri, and the eyes scarcely perceptible, may form a new subgenus.

*Mysetus*, are Siluri with a second or adipose dorsal fin. They are found in the waters of Guiana.

*Pimelodes*, body naked, and no lateral armature; but the subgenus requires division and subdivision. First, *Bagrus* has small crowded teeth in both jaws and the vomer, and may be subdivided by the number of cirri, and the shape of the head. With eight cirri, some have the head long and depressed, and others short and broad. With six cirri, some have the snout as depressed, and broader than that of the Pike; others have the head oval, and a kind of helmet of shagreen-like bones; in others, the head is round and naked; while others, again, have the head greatly depressed, the eyes low down, and the adipose fin very small; and there are yet others which have only four cirri. [Some of these, as *Pimelodes cyclopum*, are ejected in hot water from volcanoes.]

*Pimelodes*, properly so called, want the teeth in the vomer, but often have them in the palate; the cirri and form of the head differ more than in the preceding subgenus; some have but a single row of teeth; some have the head helmeted, and a distinct bony plate between the helmet and the dorsal spine; others have a single plate from the snout to the dorsal; others, again, have the head oval and naked; some with six cirri, and others eight; some with a large naked head are called Cats, which have six or eight cirri; then there are others which have the head small and flat, the dorsal minute, and the teeth scarcely perceptible; there are others still which have teeth on the palates, sometimes like velvet, or like a card, with a buckler on the nape, distinct or united to the helmet, and the palatal teeth sometimes like a helmet; some singular ones have teeth like a card, under the skin of the cheek, and moveable; others yet have a lengthened snout, or a pointed one, nearly toothless. These last lead to,—

*Synodontis*, with the snout narrow, and the lower jaw supporting an assemblage of teeth laterally flattened, ending in hooks, and individually attached to flexible peduncles. The helmet extends in one plate to the first spine of the dorsal, which is very strong, as are also those of the pectorals; the cirri, and sometimes the maxillaries, are barbed. They are found in the Nile and other African rivers, but are not eaten.

*Ageniosus*. Some of these have the maxillary turned up in a kind of toothed horn, instead of a fleshy cirrus; and others have it concealed under the skin, with the dorsal and pectoral spines scarcely visible.

*Doras*, have an adipose dorsal, with plates in the lateral line, armed with keels or spines; the dorsal and pectoral spines strongly toothed, the helmet rough, and the shoulder-bone pointed backwards. Some have teeth only in the upper jaw; others have the snout pointed, and the teeth absent, or hardly visible, with occasional lateral bristles to the cirri.

*Heterobranchus*, head broad, from the helmet having two lateral pieces of the frontal and parietal bones; operculum smaller, but with a tree-like ramification on the third and fourth gill-arch, as a sort of supplemental gills; viscera like the rest of the family, but they have from eight to fourteen gill-rays, strong pectoral spines, no dorsal one, and the body long and naked. They inhabit the rivers of Africa, and some of those of Asia. Their flesh is indifferent, or bad.

One of them, however, *Macropteronotes*, with a single indented dorsal, constitutes a considerable article of food in Egypt and Syria, where it is called the Sharmuth, or Black Fish. Others have a dorsal with rays, and also an adipose one. *Protochus*, have a second dorsal, with rays; and this and the anal long, and uniting to form a tail like an Eel; lips fleshy; conical teeth in front of the mouth, globular ones behind, and those above placed on the vomer; skin naked; nine or ten gill-rays; eight cirri; and a singular branched appendage behind the vent, besides the tubercle common to the family. Some have large and toothed dorsal and ventral spines; others have them almost concealed under the skin. They are found in the East Indies.

*Callichthys*, have the sides armed with four rows of scaly plates; head the same, but the snout and under-part of the body naked; one ray in the second dorsal; pectoral spines strong, and dorsal one feeble; mouth small; teeth barely visible; four cirri; eyes small, and lateral. They can crawl out of the water like an Eel. [These are the subgenera of Silurus].

*Malapterurus*, has no dorsals with rays, but only a small adipose one in the tail, and no spines in the pectorals. The skin is smooth; the teeth small and crowded, and are ranged into a broad crescent in each jaw; there are seven gill-rays; and the jaws and viscera are like those of Silurus. *M. electricus*, the Raasch, or Thunder-fish of the Arabs, is the only known species. It has six cirri, and the head more slender than the body, but enlarged in front. Like the Torpedo and Gymnotus, it can communicate an electric shock, the organ of which is situated between the skin and muscles, and consists of a cellular tissue, inclosing a fluid, and abundantly furnished with nerves. It is found in the Nile, and the rivers of Central Africa.

*Aspredo*, have the head flattened, and the anterior part of the body much widened; the tail long; the eyes small, and placed upwards; the intermaxillaries under the ethmoid directed backwards, and with teeth on the posterior edge only; and they have the whole gill apparatus immovable, being soldered to the temporal bone and the preoperculum; gill-opening a mere slit behind the head, the membrane of five rays adhering everywhere else; the lower jaw is transverse, and shorter than the snout; the first ray of the pectorals is more toothed than in any other of the family; there is but one dorsal, with a weak first ray; but the anal is long, extending under the long and slender tail. Some have six cirri, some eight; and, in the latter case, one pair are attached to the maxillaries, the others to the lower jaw in pairs.

*Loricaria*, have hard angular plates on the head and body; small intermaxillaries suspended under the muzzle; transverse disunited mandibles, supporting hooked teeth, which are long, slender, and flexible. A large membranous veil encircles the opening; the pharynx is furnished with numerous pavement teeth; the gill-lids are immovable, but two small plates supply their places; they have four

gill-rays; strong spines in the first dorsal, pectorals, and even ventrals; but neither cœca nor air-bladder. They form two subgenera:—

*Hypostomus*, have a small dorsal with one ray; the labial veiled with papillæ, with a small cirrus on each side; no plates on the belly; and the intestines spirally convoluted, and as slender as a thread. They inhabit the rivers of South America.

*Loricaria*, have one dorsal forwards, the labial veiled with cirri, plates on the under parts of the body, and the intestines moderately large.

#### THE FOURTH FAMILY OF THE MALACOPTERYGII ABDOMINALES.

##### SALMONIDÆ (the SALMON, or TROUT, Family).

According to Linnæus, these formed but one great genus, characterized by a scaly body, all the rays of the first dorsal soft, and the second dorsal adipose, or formed of skin inclosing fat, and without rays. They have numerous cœca, and an air-bladder. Most of them ascend rivers; and their flesh is highly esteemed. They are naturally voracious; and as the form and armature of their jaws vary greatly, they may be arranged into the following subgenera:—

*Salmo*, Salmon and Trout, properly so called.—These have great part of the margin of the upper jaw formed of the maxillaries; a row of pointed teeth in the maxillaries, the intermaxillaries, the palatals, and mandibularies, and two rows on the vomer, the tongue, and the pharynx,—being, in fact, the most completely toothed of all fishes. In old males, the extremity of the lower jaw is bent up towards the palate, where a groove receives it when the mouth is shut. The ventrals are under the first dorsal, and the anals under the adipose one. They have six gill-rays, or thereabouts; the stomach is long and narrow, with numerous cœca; their air-bladder extends the whole length of the abdomen, and communicates anteriorly with the gullet. Many species are spotted, and their flesh is in general very good. They ascend rivers to spawn, often leaping over cascades of considerable elevation, and finding their way to the brooks and small lakes of the most lofty mountains. [They are understood to return almost invariably to the rivers in which they are produced; and therefore the fixing, at the mouth of a river, of any sort of bar to their progress upwards, is sure to drive them from the estuary. According to Mr. Yarrell, one of the very best authorities, all the family are clouded with transverse dusky patches when very young,—analogous to what occur on all the species of Cats.]

*S. salar*, the Salmon properly so called, is the largest of the genus, with red flesh, and irregular brown spots, which disappear in fresh water; the cartilaginous beak of the male is not much hooked. They inhabit the seas of comparatively cold regions, whence they ascend the rivers for the purpose of spawning, at different times of the year according to the climate,—some in autumn, some in winter, and some in early spring. [The efforts which they make to overcome difficulties in the ascent are very great; and when they have made some progress up the fresh water, it is equally cruel and impolitic to capture them. It should seem that, in most of the British rivers, Salmon are diminishing in numbers, and becoming inferior in quality, the cause of which has not been explained in a satisfactory manner. In Ireland, where they have more recently become an article of commerce, they are found in considerable abundance. Salmon Fry have the tail forked, and the fork disappears as the fish advances in age; but the margin does not become convex, as in the Bull-trout.] *S. humatus*, is whitish, spotted with red and black; and the snout of the male is narrow, and much crooked in the lower jaw. Its teeth are more robust than those of the true Salmon, and its flesh as red; but it is inferior in quality. It is found in the mouths of rivers. *S. schieffermulleri*, the Sea-trout, is smaller than the former, with the teeth more slender and longer. The flanks are sprinkled with small crescent-shaped spots, and the flesh is paler than that of the Salmon. *S. hucho* [perhaps the Bull-trout, or Gray Trout], grows to almost the size of the Salmon, and has strong teeth, and a pointed lower jaw in the male.

The remaining Trouts are found in all the clear streams of Europe, especially among mountains; and they are subject to great variations from age, food, and the nature of the waters; but these do not appear to account for all the differences. [In the same river, Trout are yellowish brown, with bright crimson spots, where the water is fine and pure; and lurid and dark, and greatly inferior in flavour, where it is tinged with peat.] *S. lemanus*, Geneva Trout, found in that lake, and some neighbouring ones; ground colour whitish, with small blackish spots on the head and back; sometimes forty or fifty pounds in weight: the flesh is white. *S. trutta*, Salmon Trout, bluish black above, pale on the sides, silvery on the belly, with cross-shaped spots towards the upper part, migratory in clear streams, and esteemed next in value to the Salmon. [It varies a good deal in colour; and, from its silvery lustre, it is called White Trout in some parts of Britain.] *S. fario*, the Common, or River Trout, is generally smaller than the last, spotted with brown on the back, and crimson on the flanks,—the crimson spots usually surrounded by a pale-coloured circle; common in all the clear streams of temperate countries, and sometimes found two feet and a half long, and fifteen pounds in weight. [The *Gillaroo* Trout of the Irish lakes appears to be a variety, in which the internal coating of the stomach is modified a little to suit the nature of the food. *S. ferax*, the Great Grey Trout, inhabits the deeper lakes, and grows to a large size, but its flesh is inferior.] *S. savelinus*,

the Welsh Char, or Torgoch, has red spots in the flanks, an orange belly, and red pectorals, with the first ray very thick and white. *S. alpinus*, nearly the same colour, but the first rays of the lower fins not so much distinguished. It abounds in Lapland, where it is very valuable. *S. umbla*, Northern Char, found in various British lakes, and also in the Lake of Geneva. [There are various other members of the genus *Salmo*, but the line of distinction between species and variety is sometimes not easily drawn.]

*Osmerus*, the Smelt, has two rows of teeth on each palatal, but only a few in front of the vomer. Form like a Trout, but only eight gill-rays, and the body brilliant silvery, with some greenish reflections, but with no spots. [Found abundantly in some estuaries of British rivers at particular seasons, but very local. It seldom exceeds, and rarely equals, a foot in length. Its flesh is delicious.]

*Mallotus*, mouth like the preceding, but teeth very small and crowded, and only in the jaws, palate, and tongue; eight gill-rays, body lengthened, and small scales; first dorsal and ventrals behind the middle, pectorals large, round, and nearly meeting beneath. The only known species, *S. groenlandicus*, the Capelin, classed by Gmelin among the Herrings, is remarkably abundant on the shores of Newfoundland, and used as bait in the Cod fisheries, [and sometimes as manure for the land].

*Thymallus*, the Grayling, has the jaws like a Trout, but the mouth small, and the teeth remarkably fine; first dorsal long and high, scales much larger than on a Trout, stomach thick, and seven or eight gill-rays; first dorsal long, as high as the body, spotted with black, and occasionally with red, with dusky bars on the large dorsal. Recent it smells like wild thyme, and when cooked in its perfume it is a dainty dish.

*Coregonus*, the Gurniad, has the mouth as in the last, but with few teeth, and sometimes none, the scales larger, and the dorsal shorter. There are many species or varieties of this genus; some in the sea, others in the fresh waters only, and one occurs in several British lakes. [*C. Willughbi*, the Vendace, is found in some lakes of the south of Scotland. It feeds on insects, and very minute fresh-water Crustacea.]

*Argentina*, has the mouth small and toothless, but strong hooked teeth on the tongue, and small ones before the vomer, six gill-rays, and the digestive organs like those of a Trout. *A. ephyræna*, the only known species, has the air-bladder thick, and very much loaded with *nacre*—the silvery substance used in counterfeiting pearls; it is found in the Mediterranean. The following subgenera, which have the numerous cœca of the Salmon, and the double air-bladder of the Carps, have not more than four or five gill-rays.

*Crimata*, externally like *Thymallus*, and some of them have the same teeth, differing only in the gill-rays. Others have teeth in both jaws, sharp and directed forwards. They inhabit the American rivers.

*Anastomus*, like *Thymallus*, and with small teeth in both jaws, but the lower jaw is so turned up and enlarged at the point, that the mouth appears a vertical slit.

*Gastrolepecus*, mouth as in the last, but abdomen compressed, projecting, and sharp; and sharp; ventrals small and far back, first dorsal over the anal; upper teeth conical, lower ones notched and trenchant.

*Plabucus*, have the head small, the mouth shallow, a compressed body, the ventral keel entire and sharp, a long anal, and the first dorsal opposite its commencement.

*Serrasalmus*, has the body compressed, the belly toothed and sharp, and frequently a spine in front of the dorsal. The known species inhabit the South American rivers; and, it is said, pursue ducks, and even bathers; wounding them severely with their teeth, which are triangular, notched, and very sharp.

*Tetragonopterus*, has teeth as in the former, but the mouth smaller, and no keel or tooth on the belly.

*Chalceus*, with the same mouth and teeth, has the body oblong, and the teeth on the maxillaries small and rounded.

*Myteles*, with triangular teeth hollowed in the crowns, and three points at the corners, mouth shallow, with two rows on the intermaxillaries, but none on the palate, the maxillaries, or the tongue. Some have the elevated form, falcion-shaped fins, spine directed forwards, and even the sharp and toothed belly, of *Serrasalmus*, but not the teeth. One American species grows large, and is good eating. Others have simply an elongated body, and the first dorsal between the ventrals and the anal. These are Egyptian.

*Hydrocyon*, have the point of the muzzle formed by the intermaxillaries, the maxillaries nearer before the eyes, and completing the aperture; the tongue and vomer are always smooth, but the jaws have conical teeth, and the large suborbital covers the cheek like an operculum. Some have a close range of small teeth on the maxillaries and the palatals, and the dorsal fin between the ventrals and anals. They inhabit the tropical rivers, and taste like Carp. Others have a double row of teeth in the intermaxillaries and lower jaw, a single row in the maxillaries, and none in the palate; the first is over the ventrals. They inhabit Brazil. Others, again, have a single row in the maxillaries and lower jaw, with the teeth alternately very long and very sharp, and lodging in holes of the upper jaw when the mouth is shut; there are large scales upon the lateral line, and the first dorsal is between the ventral and the anal. They are also from Brazil. A fourth type have the muzzle prominent and pointed, the maxillaries very short, and with the lower jaw and intermaxillaries with a single row of closely-set teeth; the first is between the ventral and anal, and they have large scales. They too are from Brazil. Others, yet, have no teeth in the maxillaries or lower jaw, and what they have are few, but strong and pointed; their first dorsal is directly over the ventrals. They inhabit the Nile.

*Cetharus*, have the mouth depressed, cleft at the end of the muzzle, and the upper margin entirely formed by the intermaxillaries; the maxillaries are small and toothless, occupying only the commissure; the tongue and palate both smooth, the adipose, dorsal, and great part of the caudal, covered with scales. Found in the Nile. Some have three small teeth in the upper jaw, and the body elevated, but the belly not sharp or toothed. Others have many ranks of close teeth on the jaws, which teeth are slender and forked, and the fishes themselves are elongated.

*Saurus*, muzzle short, gape cleft far behind the eyes, margin of the upper jaw composed wholly of intermaxil-

larie, long pointed teeth on the jaws, the palatals, and on the tongue and pharynx, but none on the vomer; eight or nine, often twelve or fifteen, gill-rays: the first dorsal a little behind the large ventrals; the body, cheeks, and gill lid are scaly, the intestines like those of Trouts. They are marine fishes, and exceedingly voracious. One is found in the Mediterranean, a transparent one in the lake of Mexico, and several in India, where they are dried and salted as a relish.

*Scopelus*, have the gape and the gill openings very deep. Both jaws with very small teeth, the margin of the upper formed entirely by the intermaxillaries, the tongue and palate smooth, muzzle very short and blunt, nine or ten gill-rays, a first dorsal between the ventrals and anal, and a second, in which there are slight vestiges of rays. One small species in the Mediterranean has brilliant silver spots on the belly and tail.

*Aulopus*, combines the characters of Salmon and Cod. Their gape is wide, their intermaxillaries forming the whole margin of the upper jaw; their palatals, the front part of the vomer, and the lower jaw with a band of card-shaped teeth, but the tongue and flat part of the palate are only rough. The maxillaries are large and toothless, as in many fishes, their ventrals are under the pectorals, with the external rays thick and unforked. The first dorsal answers to the first half of the space between the ventrals and anal. They have twelve gill-rays, and large scales upon the cheeks, gill-lids, and body. One species inhabits the Mediterranean.

*Sternoptyx*, are little fishes with high compressed body, the mouth directed upwards, their humeral bones forming a trenchant crest forwards, and terminating below in a little spine. The pelvis formed by a small spine before the ventrals. There are small grooves on each side of the pelvic crest, which has been considered as a sternum, and hence their name. They have an osseous crest before the first dorsal, and a little membrane answering to the second. The borders of the mouth are formed by the maxillaries. Two species are found in the Atlantic, which may become types of two distinct genera. One of these has five gill-rays, the other nine.

## THE FIFTH FAMILY OF THE MALACOPTERYGII ABDOMINALES.

### CLUPEIDÆ (the HERRING Family).

These have no adipose dorsal, and, as the Trout, they have their upper jaw formed in the middle by intermaxillaries without peduncles, and the sides by maxillaries. Their bodies are always scaly, and most of them have an air bladder and many ceca. Few of them ascend rivers, though they appear periodically upon the shores.

*Clupea*, the Herrings, have the intermaxillaries narrow and short, forming but a small portion of the jaw, which is completed on the sides by protractile maxillaries. The lower edge of the compressed body is notched by scales, resembling the teeth of a saw. The gill openings are so wide that the fishes die almost the instant they are out of the water. The gill arches towards the mouth pectinated, the stomach is an elongated sac, the air bladder long and pointed, and their bones are very slender and numerous. They consist of several subgenera.

*Clupea*, Herrings properly so called, with the mouth mean-sized, and the upper lip entire. *C. harengus* needs no description; it appears periodically in numerous shoals, [but does not breed in the Polar seas, as was once stated, as it gets southward into warm latitudes. Its flesh is dry and inferior]. *C. sprattus* resembles the Herring, but is much smaller. *C. alba*, White Bait, a small and delicate species, resorts to the top of the brackish water to mature its spawn. It is found in various estuaries, and is highly esteemed. *C. pilchardus* is about the size of the Herring, but has the dorsal more forward. It inhabits more southerly than the Herring, and is caught in vast numbers on the coast of Cornwall. *C. sardina*, the Sardine, is like the Pilchard, only smaller. It is taken in the Mediterranean, where the Herring is unknown, and also on the west coast of France. Its flavour is highly esteemed.

*Alosa*, has a notch in the middle of the upper jaw, but is in other respects like the Pilchard and Sardine. *A. vulgaris*, the Shad, is much larger and thicker than the Herring, growing to three feet in length, and it has no teeth, and a black spot behind the gills. In spring it ascends rivers, when it is much esteemed; but when taken in the sea is dry and disagreeable. *A. aita*, the Twaite Shad, has teeth in the jaws, and five or six dark spots along the side. It is the Common Shad of the British rivers; but is considered inferior to the Common Shad, or Alice Shad, as it is called, which, as a British fish, is by no means so common.

*Chatoceus*, resembles a Herring, only the first dorsal ray is prolonged in the filament. Some have the jaws equal, the muzzle not prominent, and the mouth small and without teeth. Others have the muzzle prominent, but the mouth small. The fibres of the first gills unite with those on the opposite side, and form under the palate curious pinnated points. These are from the warm seas, and they complete the subgenera of *Clupea* as at present arranged, though the following come appropriately after the Herrings, inasmuch as they have the belly sharp and notched.

*Odontognathus*, have the body very compressed, with three sharp teeth near the vent, a long but narrow anal, a small and feeble dorsal, which is always broken, six gill-rays, the maxillaries prolonged and a little pointed, and furnished with small teeth directed forwards, and no apparent ventrals. One species from Cayenne is known, resembling a small Sardine, but having the body more compressed.

*Pristigaster*, head and teeth as in the Herrings, four gill-rays, ventrals generally wanting, belly compressed, arched, and toothed. They are found in both oceans.



*Notopterus*. Gill-lids and cheeks scaly; the suborbitals, pre-operculum, and operculum have two crests; the lower jaw is keeled, the belly toothed, and the palatals and jaws have fine teeth; the upper jaw formed in great part of the maxillaries. Their tongue is set with strong crooked teeth; they have one strong and bony gill-ray; ventrals hardly visible, followed by a long anal, which occupies three-fourths of the length, and is united, as in *Gymnotus*, with the fins of the tail and back; opposite the middle of the anal there is a small dorsal with soft rays. They are found in the stagnant fresh waters of India, being the *Gymnotus notopterus* of Pallas.

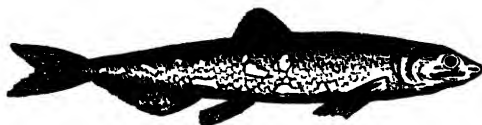


Fig. 143.—The Anchovy.

*Engraulis*, the Anchovies, distinguished from the Herrings by the mouth being more deeply cleft, the gill-openings wider, and ten or twelve gill-rays. The small intermaxillaries are fixed under a little pointed snout, in advance of the mouth, and the maxillaries are long and straight. *E. encrasicolus*, the Common Anchovy, so well known for its rich and peculiar flavour, is about a span long, and the dorsal over the ventrals. Taken

bluish above, silvery below, the abdomen not trenchant, the anal short, and the dorsal over the ventrals. Taken in vast numbers in the Mediterranean, and less abundantly in the ocean. *E. melitta* is a Mediterranean species. *E. edentulus*, an American species, without teeth.

*Thryssa*, differs from the Anchovies in having the belly toothed, and the maxillaries very long. It is an East Indian subgenus.

*Megalops*. Fins and jaws generally formed like those of the Herring, but the belly not trenchant, nor the body compressed; teeth in the jaws and palate very small and numerous; from twenty-one to twenty-four gill-rays; and the last ray of the dorsal, and often of the anal, extended in a filament. One American species, the Apalite, is found twelve feet long, has fifteen rays in the dorsal, and a filament to that in the anal. An Indian species has seventeen dorsal rays.

*Elops*, resembles the former, but is rather longer, wants the dorsal filament, has more than twenty gill-rays, and the caudal with a flat spine above and below.

*Buterinus*, has jaws like those of a Herring, a round and lengthened body, and prominent snout; the mouth shallow; the jaws with small, crowded teeth; and the tongue, vomer, and palate, have rounded ones, also closely set. There are twelve or thirteen gill-rays. This and the former genus are beautiful fishes, of a silvery colour, with many bones and cæca, and they grow to a large size.

*Chirocentrus*, has the upper jaw as in the Herring, with a row of stout conical teeth in both jaws, the two middle ones in front very long; the tongue and gill-arches toothed like a card, but not the palatal or vomer; seven or eight gill-rays, the latter ones very broad; a pointed scale above and beneath each pectoral; body long, compressed, and sharp, but not toothed on the belly; ventrals very small, and shorter than the anal, which is opposite; stomach and air-bladder long and slender. Only one known species, of the Indian Ocean, and silvery.

*Ilyodon*, has the form of a Herring, but the belly not toothed, eight or nine gill-rays, and the teeth and the mouth like those of a Trout. Found in the fresh waters of North America.

*Erythrinus*. Upper jaw almost entirely formed of the maxillaries; conical teeth in the edges of each jaw; crowded teeth in the palatals; five broad gill-rays; head round, blunt, with hard bones, but no scales; body oblong, compressed, with scales like Carp; dorsal opposite the ventrals; stomach and air-bladder large; cæca small. Found in the tropical rivers, and esteemed as food.

*Amia*, have the head like the last, but twelve gill-rays, and a hard buckler on the under-jaw; pavement-teeth behind the conical ones; nostrils tubular; stomach large; intestine wide, and with no cæca; air-bladder cellular, like the lung of a Reptile. Found in the rivers of the southern states of America, feeds on Crustacea, and is rarely eaten.

*Sudis*,—fresh-water fishes resembling *Erythrinus*, but having the dorsal and anal placed opposite each other, and occupying the last third of the body. They inhabit the rivers of tropical countries.

*Osterglossum*, differs from the last by having two cirri suspended from the lower jaw, and the tongue closely toothed like a rasp. A large species inhabits Brazil.

*Lepisosteus*, have long teeth in the edges of the jaws, and their anterior surfaces rasp-like; the scales as hard as stone; the dorsal and anal opposite, and far back; the intestine with two folds, and numerous cæca; air-bladder cellular. Of tropical America, grow large, and are good eating.

*Porypterus*. Sides of the upper jaw immovable; head covered with sharpened bony plates; body with strong scales; one gill-ray; a number of separate fins on the back; the teeth like a rasp, with long ones in front; the stomach large; double air-bladder, with large lobes, the left one opening freely into the gullet. They are found in the African rivers, and are eatable.

### THE THIRD ORDER OF BONY FISHES,—

#### MALACOPTERYGII SUB-BRACHIATI,—

Have the ventrals under the pectorals, and the pelvis suspended to the shoulder-bones. [They are thus better adapted for ascending and descending than the abdominal fishes.]



## THE FIRST FAMILY OF THE MALACOPTERYGII SUB-BRACHIATI.

## GADIDÆ (the Cod Family).

This family are almost wholly included in the great genus *Gadus*, easily known by having the ventrals inserted under the throat, and pointed. The body is moderately long, a little compressed, and covered with small soft scales; the head is well-proportioned, but naked: all their fins are soft; the jaws and front of the vomer have unequal-pointed teeth, of medium or small size, disposed in several rows, like a card or rasp; the gill-openings are large, and there are seven rays. Most of them have two or three fins on the back, some behind the vent, and a distinct caudal fin. The stomach is a large and strong sac; and the intestine long, with numerous cæca. The air-bladder is large and strong, and often notched in the margins. The greater number live in the cold or temperate seas, and furnish a most important branch of the fisheries. Their flesh is white, easily separable into flakes, and, generally speaking, wholesome, easy of digestion, and agreeable to the palate. [Taken altogether, they are probably more really serviceable to Man than any other family of fishes. Their reproductive powers are great, and their numbers countless; and they have the advantage of being generally found in vast shoals, at particular places.] They can be subdivided as follows:—

*Morrhua*, Cod, properly so called, with three dorsals, two anals, and a cirrus at the point of the lower jaw. They are the most numerous and valuable of the family, consisting of three sections, or species:—*G. morrhua*, the Cod, two or three feet long, with the back spotted brown and yellow; inhabits all the north seas, and multiplies exceedingly in the colder latitudes. They are taken in vast numbers for salting, and also for immediate use. [Their appearance and quality vary a good deal with the nature of the ground.] *G. aeglefinus*, the Haddock, brown on the back, silvery on the belly, with the lateral line, and a spot behind the pectoral fin, black. Almost as numerous in northern latitudes as the Cod, but less esteemed. [When the Haddock is taken in deep and clear water, it is perhaps the most delicate, and at the same time the most savoury of the whole family; but it does not take salt so well as Cod.] *G. callarius*, the Dorse, spotted like the Cod, but smaller, and with the upper jaw longest. It is much esteemed in the north, when eaten fresh. [Besides these, there are various sub-species, or varieties, of all the three kinds, some of them found on the British shores.]

*Merlangus*, the Whiting, with the same fins as Cod, but no cirri. Of these, *G. merlangus*, the Whiting, is well known from its abundance, and the lightness of its flesh. It is pale, reddish grey above, silvery below, has a long upper jaw, and is about a foot in length. *G. carbonarius*, the Coal-fish, twice the size of the Whiting, blackish brown, with the upper jaw short, and the lateral line straight. The flesh of the full-grown one is coarse and tough, but it takes salt like Cod. *G. polackius*, the Pollock, jaws like the Coal-fish, brown above, spotted on the flanks, and silvery below. It is abundant in the Atlantic; and better than the Coal-fish, but inferior to the Whiting.

*Merluccius*, the Hake, with only two dorsals, one anal, and no cirri, sometimes exceeds two feet; the back brownish grey, the first dorsal pointed, and the lower jaw longest. It is a coarse fish, but captured in great numbers, and salted. There are some species in high southern latitudes.

*Lota*, the Ling (which means the Long Fish), has two dorsals, one anal, and some cirri at the mouth. *G. molva*, from three to four feet long, olive above, silvery beneath, dorsals equally high, lower jaw a little shorter than the upper, and with a cirrus. This species salts well, and is not inferior to Cod: hence it is a very valuable object in the fisheries.

*G. lota*, the Burbot, from one to two feet long, yellow mottled with brown, dorsals of equal height, and one cirrus; head slightly depressed, and body cylindrical. It ascends rivers, and its flesh and flavour are highly esteemed. [The livers of most of the family are large, and furnish a great deal of oil, highly valuable in the dressing of leather, and other operations of the arts.]

*Motella*, the Rockling. Body lengthened, first dorsal scarcely perceptible, second and anal very long, and three or more cirri. *M. vulgaris*, the Three-bearded Rockling, has two cirri on the nose, and one on the lower jaw. It is fawn-coloured, with brown spots. *M. quinquecirrata*, the Five-bearded, has four cirri on the upper part, and one on the chin. It is dark-brown on the upper part, and seldom attains any considerable size.

*M. glauca*, the Blackarel Midge, is about an inch and a quarter long, bluish-green on the upper part, and silvery below, and on the fins. *M. argenteola*, the Silvery Gade, is also a small fish, with three cirri, and coloured nearly like the former.

*Brosomus*, the Torsk, is a northern species, with a long body, a dorsal along the whole back, one barbule on the under jaw, and the ventrals fleshy. It grows to the largest size in its native north.

*Brotula*, from the West Indian seas, with the dorsal, anal, and caudal, forming one fin, which ends in a point.

*Phycis*, Fork-beard, have a single ray in each ventral, which is produced and forked. They have also a small barbule on the chin. There are one or two British species.

*Raniceps*, the Tadpole Fish, has the head broad and depressed, and the first dorsal scarcely visible.

*Leptodoleprus*, a separate genus, having some relation to the Cod. Their suborbitals are united with the nasal bone, and form a depressed muzzle, advancing before the mouth, which, however, retains its mobility. Head and body with hard spinous scales; the ventrals are a little on the throat; the pectorals of mean size; the first dorsal high; the second dorsal, anal, and caudal united; the jaws short; the teeth fine and short. They inhabit

deep water, and utter a grunbling sound when drawn up to the surface. Two species are known, inhabiting the depths of the Mediterranean and Atlantic.

## THE SECOND FAMILY OF THE MALACOPTERYGII SUB-BRACHIATI.

### PLEURONECTIDÆ (the FLAT-FISH, or FLOUNDER Family).

These are all included in the great genus *Pleuronectes*, which have a character quite unique among vertebrated animals: this consists in the want of symmetry in the head. [An animal is said to be symmetrical when it is supposed to be divided in a mesial plane, or plane exactly along the middle, in a vertical direction,—the two sides being the exact counterparts of each other, and differing in nothing but in the one being turned to the right, and the other to the left.] These fishes have both eyes on one side, and this side always remains uppermost when the animal is swimming, [while all other fishes swim on the belly.] The upper side is in general deeply coloured, while the other side is whitish. The body, from the head backwards, though formed nearly as usual, partakes a little of this peculiarity. The two sides of the mouth are not equal, and the pectoral fins are rarely so; the body is depressed, and elevated in the direction of the spinous processes; the dorsal extends along the whole back; the anal occupies the lower edge of the body, and the ventrals are sometimes united with it. [The fins are thus lateral fins, in respect of the swimming of the fish when in motion; and the action of the spine is vertical, in respect of that position, and not lateral, as in other fishes.] They have six gill-rays; the abdominal cavity is small, but extends in a cavity imbedded in the flesh on the two sides of the tail, for the purpose of containing some of the viscera; they have no air-bladder, and they seldom rise far from the bottom. Notwithstanding the peculiarity of the cranium, by that twist of the neck which brings both eyes to one side, the bones are the same as in other families, but very differently proportioned. They are found along the shores of almost all countries; and are, generally speaking, wholesome and agreeable eating.

Some individuals have the eyes placed in the opposite side to that in which they are generally found in their species, and these are said to be reversed. Others have both sides coloured alike, in which case they are called "Doubles." It is usually the coloured side which is doubled, though occasionally it is the white one. They are subdivided as follows

*P. platessa*, Plaice, have a row of sharp teeth in each jaw, and very often pavement-teeth in the pharynx; the dorsal does not advance more forwards than the upper eye, and both it and the anal terminate and leave smooth spaces before the base of the caudal; they generally have two or three small coeca, and six gill-rays. *P. vulgaris*, Common Plaice, has six or seven tubercles, forming a line between the eyes, and spots of Aurora red over the brown on the upper side of the body. The height is but a third of the length; and the flesh is soft, and soon decomposes. *P. fesus*, the Flounder, similar, but with the spots lighter; some tubercles on the head, and some on the base of the dorsal and anal fins; and have rough scales on the lateral line. They ascend a considerable way up rivers, and reversed individuals are not unfrequently caught. *P. limanda*, the Dab, has the eyes large, the lateral line curved above the pectoral, the scales rough, and the upper side brown, with whitish spots. *P. microcephalus*, the Laminder, with the eyes smaller, nearer each other, and the back finely mottled with brown and yellow. [Both these are found in the salt water, as is also *P. leminoides*, the Long, or Rough Dab, which has the body elongated, something like a saw, and it approaches that species and quality. *P. pola*, the Crayed Fluke, has the head small, the right eye considerably in advance of the left, with the body yellowish-brown, and the fins darker. [All these, and some other species, are found on the British shores, chiefly on muddy or sandy bottoms.]

*Hippoglossus*, the Halibut. Shape and fins like a Flounder, lateral line arched, attains the length of six or seven feet in the northern seas, and weighs from three to four hundred pounds. Its flesh is rather coarse and dry, but it admits of being salted. There are several small species in the Mediterranean, some of which have the eyes on the left side, [whereas all the others hitherto noticed have them on the right side, unless when understood to be reversed;] and one is oblong, with a straight lateral line, and large scales.

*Rhombus*, the Turbot genus. Teeth as in the Halibut, but the dorsal advances in front of the eyes, and the anal comes to the edge of the jaws. The eyes are generally on the left, and in some they are separated by a low crest. *R. marinus*, the Turbot, is the most esteemed of the family. Its height is nearly equal to its length, its form a truncated rhombus, and with the lateral line much arched. The upper or left side is brown, and beset with tubercles; but reversed specimens are sometimes taken. *R. vulgaris*, Brill, is rounded on the sides, has the body without tubercles, and the first rays of the dorsal split into filaments. The eyes are usually on the left side. It is not so much esteemed as Turbot, still it is a good fish. *R. airtus*, Topknot: mouth small, almost vertical; teeth distinct and sharp; colour reddish-brown, mottled with black, with a large spot on the lateral line near the tail, but not so conspicuous as in one other species, which has the body turned the other way, or the eyes on the right side, and the lateral line nearly straight. *R. megastoma*, the Whiff: body oblong, mouth wide, lateral line nearly straight, upper colour brown: it is not much esteemed. *R. arnoglossus*, the Scarlet Fish: oblong, eyes to the left, fin-rays extending beyond the membrane, and of a yellowish-brown colour.

*Solea*, the Sole. Eyes on the right, mouth twisted in the opposite direction, and with teeth only in the sides opposite to the eyes; form oblong; snout rounded, generally in advance of the mouth; dorsal and anal margining all the sides of the body. *S. vulgaris*, the Common Sole, is dark-brown on the upper part, with a strong skin and small scales, and white on the under. *S. pegusa*, the Lemon Sole, is paler in colour, and wider and thicker than the Common Sole. All the Soles are excellent fishes, and may be had in good condition nearly all the year.

*Menochirus*, resembles the Sole, but has only one small pectoral on the same side with the eyes, which is the right side in all the Soles. The Variegated Sole of the Mediterranean—occasionally found on the British coast—is an example.

*Achirus*, are Soles entirely without pectoral fins, some having the ventrals distinct, and others having them united to the anal.

### THE THIRD FAMILY OF THE MALACOPTERYGII SUB-BRACHIATI.

#### DISCOBOLI (Fishes with the ventrals formed into a Sucker, or Disc).

The disc formed by the ventrals is the family characteristic, and they consist of two genera, both of which have the power of attaching themselves to rocks and other hard substances, by means of the disc, and thus they are capable of remaining in situations where otherwise the current of the water would carry them away. [This curious property enables these fishes to remain and find their food in situations where every other species of fish would be swept away by the current of the water.]

*Lepidogaster*.—These small fishes have large pectorals reaching to the under-side of the body, where they consist of stouter rays, incline forwards, and unite with each other by a transverse membrane directed forwards under the throat, and composed of the united ventral fins. Body without scales; head broad and depressed; snout curved and protractile; gills with little opening, and four or five rays; only one soft dorsal opposite the anal, and both reaching to the base of the caudal. Intestines short, straight, and without cæca. They have no air-bladder, but they swim briskly. There are two subgenera:—

*Lepidogaster*, properly so called, have the membranes representing the ventrals extended to one complete disc; and behind this, another disc, formed by the united pectorals. Some have the dorsal and anal united to the caudal, and others not. [There are several British species found on the south and west coasts; but they are small, and of no interest, except to naturalists.]

*Gobiesox*, have the disc entire, but with a cleft on the sides, and the membrane produced; the gill-opening wider, and the dorsal and caudal smaller, and separated from the anal. [Of this there is one small British species, not above an inch and a half in length, bright red above, and paler below. The sucker adheres readily to any wet surface, but not to a dry one.]

*Cyclopterus*.—Rays of the ventrals suspended round the pelvis, united by a single membrane, and forming the disc; mouth wide; small pointed teeth in the jaws and pharynx; gill-lid small, and opening close below; six gill-rays; pectorals large, almost meeting under the throat, so as to surround the disc there, but forming no part of it. Their bones are soft; skin naked and mucous, but studded with hard granulations; stomach large, and with numerous cæca; intestine long; air-bladder moderate. There are two subgenera:—

*Lumpus*, have the first dorsal more or less visible, but with simple rays; the second opposite the anal, with branchial rays; the body is thick. [The Lump-fish is found in the British seas, and as far north of them as the margin of the polar ice. When in good condition for the table, it is red, or rather various shades of blue, purple, and reddish orange; but when out of season, it fades to a dull blue. It attains considerable size, and is a high and thick fish,—the height being about half the length, and the thickness half the height.]

*Leparus*, with a single dorsal, and this and the anal both long; the body long, and compressed towards the tail. [There are one or two British species, some of which are called "Snail-fishes," from their soft and unctuous texture, and the readiness with which they adhere to rocks.]

*Echeneis*. This genus, like *Pleuronectes*, might form a distinct family of Sub-brachial Malacopterygii. They have a disc on the head, formed of cartilaginous laminae, ranged transversely or obliquely backwards, and with teeth or spines on their posterior edge. These are moveable, so that by means of them the fish can attach itself firmly to a rock, the bottom of a ship, or any other substance; and it is owing to this that it used to be alleged that these fishes could at once arrest the course of the swiftest vessel. Body long and scaly, a small dorsal opposite the anal, top of the head flat, lower jaw projectile, teeth small, tongue and vomer rough, eight gill-rays, large stomach, short intestine, six or eight cæca, and no air-bladder. This species are not numerous, and they inhabit generally the warmer seas. [*E. remora*, the Common Sucking-fish, is abundant in the Mediterranean; and has been met with as a straggler on the British shores,—Dr. Turton having found one riding on the back of a Cod-fish, at Swansea, in 1806. The West Indian species are larger.]

## THE FOURTH ORDER OF BONY FISHES.

## MALACOPTERYGII APODA.

The fishes in which ventral fins are always wanting, form but one natural family.

*Murenide*, or Eel-shaped Fishes, which are lengthened in form, have the skin thick and soft, the scales almost invisible, and but few bones. They have no cœca, but almost all have air-bladders, often singularly shaped.

The genus *Muræna* is easily known by small operculæ, surrounded by concentric rays buried in the skin, and opening only by a hole at some distance backwards, which arrangement, by protecting the gills, enables these fishes to live long out of the water, [and crawl for some distance over-land, when such a journey is necessary.] Body long and slender, scales visible only on the dried skin, no ventrals or cœca, and the vent far backwards. This extensive genus may be subdivided as follows :—

*Anguilla*, known by the pectoral fins, and the gill-openings under them; stomach a long cul-de-sac, intestine straight, and a peculiar gland near the middle of the long air-bladder. They are again subdivided :—*Anguilla*, the true Eels, have the dorsal and caudal meeting at the extremity of the tail, and forming a point, and the dorsal beginning a considerable way behind the pectorals. [They have also a singular pulsatory apparatus for the circulation of lymph, situated near the extremity of the tail. They are, strictly speaking, fresh-water fishes; but they migrate to the sea in the end of the season, bury themselves in the sludge there, and mature their spawn, again ascending the rivers for the purpose of spawning. Like Trout, they are much affected in appearance and quality by the waters which they inhabit. Three species are known as British Eels :—*Acutirostrus*, the Sharp-nosed Eel; *Latirostrus*, the Broad-nosed Eel; and *Mediostrostrus*, the Snigg Eel. Eels are delicate fishes, and not found in very high latitudes. In Britain they are most abundant, and best in quality in the pure rivers which rise in the chalk districts.]

*Conger*.—Dorsal commencing near or at the pectorals, and upper jaw longest. The Conger is found in most European seas; and is sometimes from four to six feet long, and as thick as a man's leg. The margins of the dorsal and anal are black, and the lateral line marked with white spots. *C. myrus* of the Mediterranean is smaller than the Conger, and has whitish spots on the snout and the occiput. In some foreign ones, the dorsal begins before the pectorals.

*Ophidurus*, Snake Eels, differ from the former in having a portion of the extremity of the tail without fins, and ending in a pouch like the tail of a Serpent. *O. serpens* of the Mediterranean is brown above, silvery beneath, has the snout slender and pointed, grows to the length of six feet or more, and is as thick as a man's arm. Some foreign species have the pectorals much smaller, which gives them a little the appearance of the genus.

*Muræna*, which have no pectorals, very small gill-openings, gill-lids thin, and the rays not easily discernible; the stomach short; the air-bladder small, and placed in the upper part of the cavity. Some have one row of sharp teeth in each jaw, among which is, *M. helena*, common in the Mediterranean, and much esteemed by the ancients, who carefully fed it in ponds. The story of Vædus Pollio, who caused his offending slaves to be flung alive into the ponds to feed the Muræne, is well known. They grow to the length of three feet or more, are mottled brown and yellow, and very voracious and ugly.

Others have two rows of sharp teeth in each jaw, and one on the vomer; and others, again, have round or conical teeth, as *M. unicolor* of the Mediterranean, which appears uniformly brown, though marked with small lines and modellings. Others have two rows of teeth on the vomer, and a single one on the jaws; others, again, have two rows on the jaws, and four, like a pavement, on the vomer; and others still have several rows of card-teeth, as *M. saga*, with long, round, and pointed jaws, and the tail ending in a very sharp point.

*Sphegobranchus*, have the gill-openings near each other below, the fins apparent only near the tail, and the snout long and pointed. Some want pectorals, others have mere vestiges, and others still are totally finless.

*Monopteras*, have the gill-openings united, but with a partition; the dorsal and anal apparent only from the middle of the tail backwards; card-teeth on the jaws and palate; six gill-rays, and only three very small gill-arches. The known species is from the Moluccas, and it is green above and fawn-coloured below.

*Synbranchus*.—Gill-opening entirely single, no pectorals, fins fatty, head thick, snout rounded, operculum cartilaginous, with six rays, stomach and anal perfectly straight, and bladder long and narrow. Found in the seas of hot countries.

*Alabes*, have one gill-opening; pectorals well marked, with a disc between them; gill-lids small, with three rays; teeth pointed; and intestines as in the last. The well-known species inhabits the Indian Ocean.

Here should be placed a recently-discovered fish, one of the most singular of the whole class, namely :—

*Saccopharynx*, which can inflate the thorax to a large tube, which terminates in a very long and slender tail, with long upper and under fins meeting at the point. Teeth sharp, mouth opening behind the eyes, which are very near the point of the snout, and gill-opening a small hole under the pectorals. Grows large, and appears to be voracious; but only a few specimens have been seen floating in the Atlantic, by means of the inflation of the thorax.

*Gymnotus*.—Gills partially covered by membranes, but opening before the pectorals; vent far forwards; anal fin occupying the under line of the body, generally to the extremity of the tail, but no dorsal. They admit of subdivision :—

*Gymnotus*, the true Electric Eels, have no caudal or dorsal fin, nor visible scales; moderate intestines, with several flexures, and numerous coeca; stomach short, and plaited on its inner surface. One long air-bladder extends in a cavity of the abdomen; the other, in two lobes, is placed over the gullet. Found only in the rivers and stagnant fresh waters of tropical America; and the most celebrated is,—

*G. electricus*, the Electric *Gymnotus*, called from its form the Electric Eel. It attains the length of five or six feet, and communicates shocks so powerful that men and horses have been stunned by them. This power is voluntary, and can be sent in a particular direction, and even through the water, the fish in which are killed, or stunned, by its shocks. By giving these, it is greatly exhausted, and requires both rest and nourishment before it can renew them. The immediate organ of this power extends along the whole under-side of the tail, occupying about half its thickness. It consists of two large longitudinal fasciculi above, and two smaller ones below, resting on the base of the anal fin. Each fasciculus is composed of numerous parallel membranes, nearly horizontal, and close to each other, one end being attached to the skin, and the other to the mesial plane. They are joined by numerous transverse and vertical membranes; and the canals and cells thus formed are filled with gelatinous matter. The whole apparatus is largely supplied with nerves, [affording one striking instance of the intimate connexion between electric or galvanic action in matter, and nervous action in living animals.]

*Carapax*, has the body compressed and scaly, and the tail much narrowed. They live in the South American rivers.

*Stenarchus*, have the anal separated from the tail, and a caudal,—a soft filament along the back, lodged in a groove, in which it is retained by tendinous threads, and reaching the whole way to the tail. It has some freedom of motion, but the use of it is not known. The head is oblique, compressed, and naked, with the skin hiding the operculum and gill-rays; the body scaly; the teeth small and crowded, and scarcely discernible in the middle of the jaw. Like the rest of the genus, they inhabit the waters of South America.

*Gymnarchus*.—Body long and scaly; gill-opening before the pectorals; a soft-rayed fin along the back, but no anal, and the tail ending in a point; head naked and conical; mouth small, and with a single row of cutting-teeth. *G. niloticus*, the only known species, inhabits the Nile.

*Leptocephalus*.—Gill-opening before the pectorals; body compressed and ribbon-like; head very small; snout short, and a little pointed; pectorals nearly or totally wanting; dorsal and anal obscure, but extending to the point of the tail; the viscera occupying a small cavity along the under-part of the body. One species is found in the British seas. *L. morrisii*, the Anglesey Morris, is a very little fish, silvery, and semi-transparent, but with bright and prominent rays, and is very lively in its motions. It lurks in sea-weed; and is one of those animals, exceedingly rare among Vertebrata, of which the internal structure can be seen without dissection, and its action understood accordingly. Other species have been found in the warm seas.

*Ophidium*, resembles the Eels in having the vent far backwards, and the dorsal and anal meeting at the point of the tail; and the body is so long and compressed, that the fish has been compared to a sword-blade. The skin has minute and buried scales, as in the Eels, but the gill-openings are large, and the gill-lids have free motion; the dorsal rays are joined, not branched; some have small barbules, others none, and some short cirri; some are flesh-coloured, with black fins; some brown, and some large ones are rose-colour, with brown spots.

[The species without cirri, the *O. imberbis* of Linnæus, has been made a subgenus by Cuvier, under the name of *Fierasfer*, in which the dorsal seems a mere fold of the skin. A specimen, about three inches long, has been met with on the south coast of England].

*Ammodytes*, have the body like the former, a fin with simple-jointed rays along the back, an anal fin, and a forked caudal, and the fins are not united; snout sharp; upper jaw extensile, and shorter than the lower in the closed mouth; stomach fleshy and pointed; no coeca, or air-bladder. They burrow in the sand, and are captured by digging it at low water; and are understood to contribute materially to the support of Salmon in the estuaries. There are two species:—*A. tobianus*, the Sand-eel; and *A. lancea*, the Sand-lance. The latter is thicker in the body than the former, with the intermaxillaries larger, and the dorsal commencing farther forward. They are both found on the sandy shores of Britain.

## THE FIFTH ORDER OF BONY FISHES.

### LOPHOBANCHII (FISHES WITH THEIR GILLS IN TUFTS).

All the fishes of the preceding four orders not only have a skeleton of fibrous bones, and the jaws complete and free, but their gills are always in fibres or fringes, like the teeth of a comb; but those of the present order, while they have the jaws complete and free, have the gills not in equal laminæ along the arches, but in small round tufts, disposed along the arches in pairs,—a structure of which there is no instance in other fishes. These are defended by a large operculum, attached by membranes on all sides, except one small hole for allowing the water to escape; and mere vestiges of rays are shown in the substance of the operculum. These fishes are also distinguished by shields or small plates, which cover the body, and often give it an angular form. In general, they are of small size, and almost without flesh. Their

intestine is of uniform width, and without cœca; and their air-bladder, though slender, is large in proportion to their size. They form two genera; and the first admits of subdivision.

*Syngnathus*.—These are characterized by a tubular snout, composed, as in the *Fistulariæ*, of prolongations of the ethmoid, vomer, temporals, pre-operculum, and other bones; and this snout ends in a mouth as in other fishes, only its opening is nearly vertical. The gill-opening is near the nape; and there are no ventral fins. In their reproduction there is this peculiarity, that the eggs slide into a pouch formed by an inflation of the skin, and remain there till they are hatched. This pouch is under the belly in some, and at the base of the tail in others. It bursts spontaneously, and allows the fry to escape. [Thus these fishes have some analogy to the marsupial Mammalia.]

*Syngnathus*, the Pipe-fishes, properly so called, have a very long and slender body, differing little in diameter throughout its entire length. Some have a dorsal, caudal, and anal; others want the anal only, and in these the hatching-pouch is situated under the tail. *S. acus*, the Great Pipe-fish, and *S. tytpe*, the Peak-nosed Pipe-fish, both found in the British Seas, belong to these sections. Others, again, have neither anal nor pectorals; and others no fin but the dorsal. *S. ophidion*, the Snake Pipe-fish, and *S. lumbriciformis*, the Worm Pipe-fish, are British fishes belonging to these sections. [They have the pouch under the belly; and it is to be observed that in all the species it is the male, and not the female, which has the pouch, and hatches the eggs.]

*Hippocampus*, has the body compressed laterally, and much more elevated than the tail; and in dead specimens the neck bends, and the upper part has a faint resemblance to the head and neck of a Horse in miniature, from which they have been called Sea-horses. The margins of their scales are formed into ridges, and the angles into spines. They have no fin in the tail, but that organ is prehensile, and enables them to climb or hold on by the stalks of marine plants. The common species is found in the British seas, and is sometimes about five inches long; and, on the coast of Australia, there is a longer one, with the angles of the scales extended into leafy appendages.

*Solenostomus*, differ from the former chiefly in having, behind the pectorals, large ventrals, united with each other and with the body, and forming an apron which serves to retain the eggs while hatching, in the same manner as the pouch of the Pipe-fishes. There is one dorsal of few rays near the nape, a very small one near the tail, and a large pointed caudal, but otherwise they resemble *Hippocampus*. The only known species is from the Indian Ocean.

*Pegasus*, have a snout as in the former, but the mouth under it, and moveable, like that of a Sturgeon, only composed of the same bones as in other osseous fishes. The body is armed as in *Hippocampus*, but their thorax is broad, depressed, and with the gill-openings in the sides. They have two distinct ventrals in rear of the pectorals, which are often large, and have procured these fishes the name of *Pegasus*, or Flying Horses. The dorsal and anal fins are opposite each other, the abdominal cavity is wider and shorter than in *Syngnathus*, and the intestine has two or three flexures. Some species are found in the Indian seas.

## THE SIXTH ORDER OF BONY FISHES.

### PLECTOGNATHI (FISHES WITH SOLDERED JAWS).

Though retaining many of the characters of the Bony Fishes, the members of this order resemble the Cartilaginous ones, in the imperfect structure of the jaws, and the slow ossification of the skeleton; but still this skeleton is fibrous, and resembles that of the Bony Fishes. The chief characters are—the maxillary soldered to the side of the intermaxillary, which constitutes the jaw, and the connexion of the palatal arch with the cranium by an immoveable suture. Besides, the gill-lid and rays are concealed under the thick skin, with only a small opening, the ribs are mere rivets, and there are no true ventrals. The intestine is large, and without cœca; and the air-bladder is always ample. They admit of division, by the character of their teeth, into two very natural families.

### THE FIRST FAMILY OF THE PLECTOGNATHI.

#### GYMNODONTES (Fishes with naked Teeth).

Instead of teeth, these have the jaws covered with a substance like ivory, laminated internally, and resembling the beak of a Parrot, though these are true teeth united, and are reproduced as soon as they are destroyed by using. Their gill-lids are small, with five obscure rays. They live on Crustacea and sea-weed, and their flesh is mucous, and not liked,—that of some species being reckoned poisonous, at least at certain seasons of the year.

The genera *Tetraodon* and *Diodon* have the faculty of blowing themselves up like balloons, by filling with air a thin and extensile membranous sac, which adheres to the peritoneum the whole length of the abdomen. When thus inflated, they roll over and float with the belly uppermost, without any power of directing their course; but they are remarkably well defended by spines all over the surface, which are erected as they are inflated. Their air-bladder has two lobes. They have but three gill-arches in a side; and when taken, the escape of the air from the pouch makes a sound. Each nostril is furnished with a double fleshy tentaculum.

*Diodon*, Spinous Globe-fishes, get the generic name from the jaws consisting of only two pieces, one above and the other below. Behind the trenchant edge of each piece, there is a rounded portion furrowed across, and forming a powerful grinding apparatus. The spines upon the inflated skin, which vary a good deal in the different species, present a formidable appearance. They inhabit the warm seas; but sometimes, though rarely, a specimen, brought no doubt by the Atlantic current, is found on the coast of Cornwall.

*Tetraodon*, have each jaw marked with a suture, so as to give the appearance of four teeth. The spines are small and low, and some species are reckoned poisonous. None of them is recorded as visiting Britain. One is electrical, *T. lineatus*, straight, brown and whitish: it is found in the Nile, cast on shore by the inundations, and collected by the children as a plaything.

*Orthogoriscus*, the Sun-fish, is the body compressed, spineless, and incapable of inflation, with the tail so short that it appears only the anterior half of a fish which had been cut in two in the middle. Their dorsal and anal, both high and pointed, are united to the caudal; no air-bladder, and the stomach is small; their surface is covered with mucus. They are found in many seas; and two species at least—*O. mola*, the Short Sun-fish, and *O. oblongus*, the Oblong Sun-fish—are found in the British seas.

*Triodon*.—These species have the mark of a suture on the upper jaw, but none on the under, which gives them the appearance of having three teeth. A vast membrane, as long as the body, and twice as high, is supported before by a large bone answering to the pelvis, and makes these fishes resemble Balistes, in the following family. Fins as in *Diodon*; body rough like *Tetraodon*, and the surface of the membrane roughened by a number of little oblique crests. The only known species is from the Indian Ocean.

## THE SECOND FAMILY OF THE PLECTOGNATHI.

### SCLERODERMI (Fishes with Hard or Granulated Skins).

These are readily distinguished by a conical or pyramidal muzzle, which is prolonged forwards from the eyes, and terminates in the mouth, with distinct teeth in both jaws. The skin is either rough or covered with very hard scales; and the air-bladder is large, strong, and of an oval shape. There are two genera. *Balistes*, File-fishes, admit of subdivision, and have the body compressed; eight teeth, generally trenchant, in a single row in each jaw; the skins scaly or granulated, but not ossaceous; the first dorsal composed of one or more spines, articulated with a particular bone, which is attached to the cranium, where is a groove for its reception; the second dorsal and anal long, and placed opposite each other. Though without ventral fins, they have pelvic bones attached to the shoulders. They abound in the warm seas near rocks, or on the surface of the water; and their brilliant colours sparkle in the water like those of *Chetodons*. Their flesh is disliked at all times; and they are supposed to feed on Coralline Polypi at some seasons, and become poisonous, but Cuvier found only sea-weed in such as he opened.

*Balistes* proper, have the whole body covered with long and hard rhomboidal scales, which do not overlap each other, but have the appearance of the teeth of a file; three spines on the dorsal, the first long, the third small and far back; extremity of the chest salient and prickly, with some spines in the skin behind, which have been considered as rays of ventral fins. Some have no particular armature of the tail; and of these, again, some have large scales behind the gill-openings. Such is the European File-fish—*B. capricus*, which has been occasionally, but very rarely, found on the British shores, and which is common in the Mediterranean.

*Monacanthus*.—This subgenus has very small scales, set rough like the pile of velvet; a large cirrated spine on the first dorsal, and the extremity of the pelvis salient and spinous. Some have the pelvic bone moveable, and connected with the abdomen by an extensile membrane, and frequently strong spines on the sides of the tail. Some have stout bristles on the tail, some have the body with tubercles, and others with branched hairs.

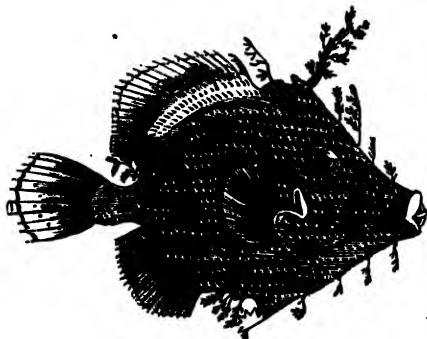


Fig. 144.—*Balistes pectiligerus*.



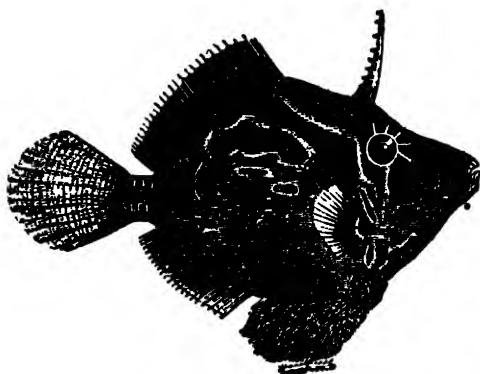


Fig. 145.—*Balistes geographicus*.

vertebræ are also soldered together. The jaws are furnished with a row of ten or twelve conical teeth; and they have no apparent gill-opening, except a mere slit with a cutaneous lobe; but inside the skin they have a gill-lid and six rays. They have neither pelvic bone nor ventrals, and the single dorsal and anal are both small; they have little flesh, but the liver is large, and abounds in oil; the stomach is also very large and membranous. Some of them are thought to be poisonous. They might be subdivided according to the form of the body and the spines, but it is not yet ascertained whether there may not be sexual differences in these respects. [The body is triangular in some, quadrangular in others, and in some it is compressed; and the appearance of the cuirass, or covering, varies still more. None has been met with on the British shores.]

*Aluterus*, have the body long, the granulations scarcely visible, and a single spine in the first dorsal, but the pelvis is completely hidden in the skin.

*Triacanthus*, has a kind of ventrals, each supported by one large spinous ray, adhering to a non-projecting pelvis; the first dorsal has one largish spine, and three smaller ones behind it; the body is crowded with small scales; and the tail is longer than in any of the other subgenera. The single known species inhabits the Indian Ocean.

*Ostracion*, the Trunk-fish, has the head and body covered in such a manner with plates of bones, soldered together, as to form an inflexible cuirass, leaving only the tail, the fins, the mouth, and a small margin of the gill-opening, capable of motion,—all of which moveable parts pass through openings of the cuirass. The greater part of the

## CHONDROPTERYGII.

The second series of Fishes, the CHONDROPTERYGII, or Cartilaginous Fishes, cannot be considered either superior or inferior to the Ordinary Fishes; for, while some of the genera resemble Reptiles in the structure of their ear and reproductive organs, other genera have the skeleton so very rudimental that one almost hesitates to regard them as vertebrated animals. They form a series, ranging parallel to the Bony Fishes, just as the Marsupial Mammalia range parallel with the other ordinary Mammalia.

Essentially, the skeleton is cartilaginous,—that is to say, it has no bony fibres, but the calcareous matter is disposed in grains. The cranium is always formed of a single piece without sutures; but there are ridges, furrows, and holes, whereby the portions of it analogous to the cranial bones of other fishes may be distinguished. Even the moveable articulations of other orders are not distinguishable in the whole of this: as, for instance, part of the vertebræ of some of the rays make a single piece, and some articulations of the bones of the face also disappear. Among the latter, the most prominent character is the reduction of the maxillaries and intermaxillaries to mere rudiments concealed under the skin, while their functions are performed by the palatals, and sometimes by the vomer. The gelatinous substance which fills the intervals of the vertebræ in other fishes, and communicates from one to another by only a small hole, is, in several of this order, a long cord, which traverses all the vertebræ, with little variation of diameter.

The series divides itself into two orders:—Those with free gills, like all other Fishes; and those with fixed gills, which are so attached to the skin by the internal edges that the water cannot escape from their intervals, except by holes in the surface.



## THE FIRST ORDER OF CHONDROPTERYGII,—

## CHONDROPTERYGII BRANCHIIS LIBERIS,—

(Or, with free gills), have in their gills a single wide opening, and a gill-lid, like the Bony Fishes, but they have no gill-rays. There are two genera.

*Accipenser*, the Sturgeon.—General form like that of the Shark, but the body more or less covered with bony plates in longitudinal rows, and the head externally armed with the same. Their mouth, placed under the muzzle, is small and toothless; and the palatal bones, soldered to the maxillaries,



Fig. 145.—The Sturgeon.

form the upper jaw, while there are vestiges of the intermaxillaries in the thick lips. Placed upon a pedicle of three articulations, this mouth is more protractile than that of the Shark;

the eyes and nostrils are on the sides of the head, and barbules are suspended from the muzzle; the labyrinth within the cranial bones is perfect, but there is no external ear—the hole behind the temple leading merely to the gills. The dorsal is behind the ventrals, and has the anal directly opposite to it; the caudal surrounds the extremity of the spine, and terminates in the upper lobe of the tail, but an under lobe gives the tail the appearance of being forked. Internally, we find the spiral intestinal valve, and the single pancreas of the Shark family; and there is a very large air-bladder, which communicates with the gullet by a large opening. Sturgeons ascend some rivers in vast numbers, and are the object of valuable fisheries. The flesh of most is agreeable, their eggs or roes are made into caviar, and their air-bladders furnish the finest isinglass.

*A. sturio*, the Common Sturgeon, occasionally found in the west of Europe and on the British shores, is about six feet long, has a pointed muzzle, five rows of plates with strong spines, and its flesh is much esteemed, being somewhat like veal. The rivers falling into the Black and Caspian Seas produce this and three other species, if not more. *A. ruthenus*, the Sterlet, is seldom more than two feet long, with the plates on the lateral line numerous and keeled, and those in the belly flat. It is considered delicious, and caviar made from it is reserved for the Russian court. There is reason to believe that this is the *Elops* and *Accipenser* so much celebrated by the ancients. *A. stellatus*, the *seroregia* of the Russians, and the *scherg* of the Germans, grows to the length of four feet, has the plaits rougher and the snout more slender than the others. It is very numerous, but less esteemed than the Common Sturgeon. *A. huso*, the Great Sturgeon, has blunter plates, a smoother skin, and shorter snout and cirri, than the Common Sturgeon. It is frequently found more than twelve, or even fifteen, feet in length, and weighing more than twelve hundred pounds. One specimen is mentioned which weighed near 3,000 pounds. Its flesh is not much esteemed, and it is sometimes unwholesome; but its air-bladder yields the very finest isinglass. It is found in the Po as well as in the northern rivers.

Several Sturgeons are found in North America, which are peculiar to that quarter of the world.

*Pollodon*, may be considered as a subgenus of *Accipenser*. These fishes are distinguished by the great prolongation of their snout, the broad margins of which give it the figure of a leaf. In the general form and fins they resemble the Sturgeons; but their gill-openings are wider, and the gill-lid is prolonged in a membranous flap, which extends to half the length of the body; their gape is much cleft, and furnished with a number of small teeth. Their upper jaw is formed by the union of the palatals and maxillaries with a pedicle of two articulations. There is a spinal cord like that in the Lamprey, and the same spiral valve which is common to most of the order; but the pancreas is partially divided into coeca. They are furnished with an air-bladder. Only a single species is known, *P. folium*, which is found in the Mississippi.

*Chimera*.—This second genus of cartilaginous fishes with free gills, closely resembles the Sharks in form, and in the disposition of the fins; but the gills open externally by one apparent hole in each side, though, if we examine more closely, we find great part of their edges attached, and that there are five separate holes terminating in the common aperture: still they have a vestige of an operculum concealed in the skin. Their jaws are more reduced than in the Sharks, for the palatals and temporals are mere simple vestiges suspended to the sides of the muzzle, and the upper jaw is represented by the vomer only: hard and undivided plates supply the place of teeth, four of them above, and two below. The muzzle, supported as in the Sharks, projects forwards, and has pores arranged in rows nearly

regular. The first dorsal, containing a strong spine, is placed over the pectorals; and the males, as in the Sharks, have a bony appendage to the ventrals; but these are divided into three branches, and they have spinous appendages before the base of the ventrals, and small spines on the point of a fleshy appendage between the eyes. Their eggs are large and flattened, with a leathery covering, and having margins. [In fact, with some singular peculiarities, they approach pretty closely to the fishes with fixed gills.]

*C. menessieri*, the King of the Herrings, and Cat of the Mediterranean, is three feet long, and of a silvery

mouthed Dog-fish. Light-brown, with ocellated spots. All the three are peculiarly destructive to the more valuable fishes. Some foreign ones have a slight difference of character.

The Sharks properly so called include all species with a produced snout, no nasal grooves, and with a caudal lobe more or less forked. They form the genus

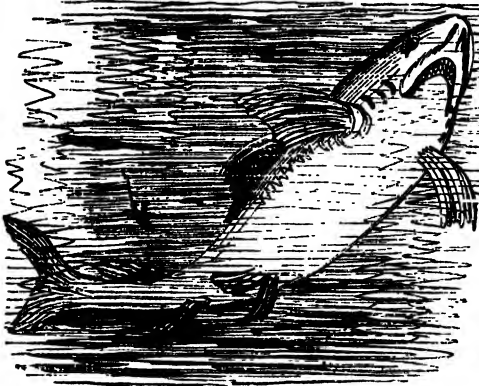


Fig. 147.—The White Shark.

*Lamna*, the Porbeagle, differs from a true Shark in the pyramidal snout, and the gill openings before the pectorals. *L. cornubica* occasionally appears on the British coast, and its size has caused it to be mistaken for the White Shark. *L. nasensis* resembles the last, but has the snout shorter.

*Galeus*.—Shaped like the Sharks, but with spiracles and an anal. *G. vulgaris*, the Tope, is found on the British shores.

*Mustelus*, resembles the former in shape, but has the teeth like a close pavement.

*Milvius*, the Smooth Hound, is a British species.

*Notidanus*, wants the first dorsal; has six gill-openings, triangular teeth above, and like a saw below. Two species inhabit the Mediterranean. Has the form of the Sharks, and spiracles, with the gill-openings nearly surrounding the neck; its teeth are small and not notched. It is the largest of the True Fishes, being sometimes thirty-six feet long; but it is a harmless fish. *S. maximus*, the Basking Shark, is found in the British seas.

*Centracion*, has spiral teeth like pavement, and a spine before each dorsal.

*Spinax*, resembles *Carcharias*, but has spiracles; no anal fin; several rows of small trenchant teeth; and a strong spine before each dorsal. *S. acanthus*, the Piked Dog-fish, is a British species.



Fig. 148.—The Hammer-headed Shark.

*Carcharias*,—a numerous and notorious tribe, with trenchant-pointed teeth, usually serrated in the margins; the first dorsal before the ventrals; the second nearly opposite the anals. They have no spiracles; the nostrils are in the middle of the snout, and the last gill-opening extends over the pectorals. *C. vulgaris*, the White Shark, is sometimes twenty feet long, with isosceles-triangular teeth, ragged at the sides, and the lower ones narrow points placed on wider bases; these teeth in the mouth of such a fish forming weapons dreaded by all mariners. Found in most seas. [Its appearance on the British shores has been mentioned, but it wants authentication.] *C. vulpes*, the Fox-shark, or Thresher.—Triangular teeth in both jaws; upper lobe of the tail as long as the whole body; second dorsal and anal very small. *C. glaucus*, the Blue Shark, with curved-aided teeth above, inclining outwards, and straighter ones below; all ragged on the edges.



Fig. 148.—The Thresher.

*Centrina*, resembles the last; but the second dorsal over the ventrals, and the short tail, give it a clumsy appearance; its skin is very rough.

*Scymnus*, the Greenland Shark, is more abundant in the Arctic seas, and is large and voracious; but is understood not to attack Man.

*Zygena*, forms a second genus. Like the Sharks in the body, but with the snout singularly produced, forming two pieces like a double-headed hammer, with an eye in the middle of each extremity. The species of the European seas grow to the length of twelve feet, [and we believe larger ones are met with in southern latitudes].

*Squatina*, the Angel Fish, has spiracles and wants the anal; but it has the mouth at the end of the muzzle; the eyes in the upper part of the head; the head round; the body broad and flattened horizontally; the pectorals large and far forward, but separated from the back by a slit in the gill-openings; their two dorsals are behind the ventrals, and the caudal is attached both to the upper and under sides of the termination of the body.

*S. angelus*, the Common Angel-fish, grows seven or eight feet long; is very voracious, and one of the ugliest of fishes.

*Pristis*, the Saw-fish, form a fourth genus. They have a long body, like the Sharks, with the gill-openings below; the snout extended like the blade of a sword, and with strong and trenchant teeth like spines on both edges. This formidable weapon gives name to the fishes, and with it they will attack the largest Whales, and inflict dreadful wounds. They sometimes attain twelve or fifteen feet in length.



Fig. 160.—The Saw-fish.

*Raia*, the Skate, [or rather, perhaps, *Raiidae*, the Skate family,] are less numerous than the Sharks. They have the body flattened till, from its union with the large and fleshy pectorals, it forms a disc. These pectorals are joined to each other before the snout; extend behind as far as the base of the ventrals, and have their humeral bones articulated with the spine behind the gills. Eyes and spiracles above; mouth, nostrils, and gill-openings below; and dorsal fins almost always on the tail. Eggs brown, leathery, and square, with points at the angles. They consist of the following subgenera:

*Rhinobatis*, connect the Sharks and Rays by their thick fleshy tail, and two distinct dorsals and a caudal. The rhomboids formed by the snout and pectorals is sharper in front and narrower than in the ordinary Rays; but excepting this they have all the characters of these, and their crowded teeth are placed in fives, like little paving-stones. Some inhabit the Mediterranean; some the Atlantic; and one species from Brazil is said, but not proved, to be electric. *Rhina* differs from *Rhinobatis* in having a stout, broad, and rounded snout.

*Torpedo*.—Tail short, but tolerably fleshy; disc of the body nearly circular, the anterior edge being formed by two productions of the muzzle, which extend outwards and join the pectorals. The space between the pectorals and the head and gills is filled by an electric apparatus, consisting of numerous cells formed like honeycombs, and subdivided by lateral diaphragms, in the intervals of which a mucous fluid is contained. This electric or galvanic apparatus is, like that in *Gymnotus*, amply supplied with nerves. The shocks given by the *Torpedo*, though smart, are not so benumbing as those of *Gymnotus*. They probably enable it to stun its prey. The body is smooth, and the teeth small and pointed. Two species, one with ocellated spots, and another with seven fleshy protuberances round the spiracles, with the back marbled, sprinkled, or spotted with brown, were long confounded with this one. There are also several species in the foreign seas. The Common *Torpedo* is occasionally found on the Channel coast of England.

*Raia*, the Rays properly so called, or Skate, have the disc rhomboidal; the tail slender; with two small dorsals on the upper part, near the point, and sometimes the vestige of a caudal; and their teeth are small, and ranged in quincunx on the jaws. The European seas furnish many species, some of which are not yet well determined. Their flesh is rather hard when recent, but wholesome. [The species found in the British seas are as follows: *R. chagrinea*, the Shagreen Ray; *R. batia*, the Blue or common Skate; *R. oxyrhynchus*, the Sharp-nosed Ray; *R. marginata*, the Margined Ray; *R. maculata*, the Homelin or Spotted Ray; *R. microcellata*, the Small-eyed Ray; *R. clavata*, the Thornback; and *R. radiata*, the Starry-ray.—*Yarrell's British Fishes*.]

*Trygon*, the Sting Ray, has on the tail a strong spine notched on both sides; teeth similar to the other Rays; the disc obtuse forwards, and the tail often without any fin save a rudimental membrane. *R. acanthus* resembles *Trygon*, but has the tail long and slender, without fin or spine.

*Miliobatis*, the Eagle Ray, has the snout projecting beyond the long pectorals, which extend outwards like wings; the jaws have broad flat teeth like a pavement; the tail is long and slender, having a spine on the upper part near the base, and not far behind the small dorsal. In some there are two or more spines.

*Cephaloptera*, has the small tail, the spine, and the small dorsal of the last subgenus; but the pectorals are more extended in proportion to the length of the body; the head is truncated in front, and a lobe of each pectoral advances on each side of it, making the fish seem as if it had horns.

## THE SECOND FAMILY OF THE CHONDROPTERYGII BRANCHIIS FIXIS.

### CYCLOSTOMATA (with the Mouth formed into a Sucker).

With respect to their skeleton these are the least perfect of fishes, and, indeed, of all vertebrated animals. They have no pectorals or ventrals; their body ends in a circular fleshy lip, with a cartilaginous ring supporting it, and formed of the soldered palatals and mandibularies. The substance of all the vertebrae is traversed by a single tendinous cord, filled internally with a mucilaginous fluid, without contractions and enlargements, which reduces the vertebrae to cartilaginous rays not easily distinguishable from each other. The annular portion is rather more solid than the rest, but not cartilaginous through its whole circle. They have no ordinary ribs, but the gill-ribs, noticed as rudimental in the Sharks and Rays, are more developed and united with each other in this family into a kind of cage, but there are no solid gill-arches. Instead of being comb-shaped, as in other fishes, the gills have the

appearance of sacs produced by the union of the faces of the proximate ones. The labyrinth of the ear is embedded in the cranium, and the nostrils opened by a single orifice, in front of which is a blind cavity, improperly thought a spiracle. The intestine is straight and slender, with a spiral valve.

*Petromyzon*, the Lampreys, have seven gill-openings on each side, and the skin on the upper and under parts of the tail is formed into fin-like crests, which, however, have no rays. The Lampreys properly so called, have strong teeth in the maxillary ring, and the inner disc of the lip, which is very circular, is covered with tubercles, hard and crusted like teeth: this ring is suspended by a transverse plate answering to the intermaxillaries, and there are vestiges of maxillaries on the sides. The tongue, which moves backwards and forwards like a piston, and performs the suction, has two longitudinal rows of small teeth. Water reaches the gills from the mouth by a particular membranous canal, a sort of trachea, placed under the gullet and perforated with holes; there is a dorsal before the vent, and another behind it which unites with the caudal. They habitually fix themselves to stones and other hard substances by means of the sucker; and they attach themselves to the largest fishes in the same manner, and in the end pierce their integuments and prey upon their substance.

The species are—*P. marinus*, the Sea Lamprey, two or three feet long, marbled with brown and a yellow ground; the first dorsal separate from the second; two large teeth on the upper part of the maxillary range. In spring they approach the mouth of rivers, and their flesh is highly esteemed. *P. fluviatilis*, the River Lamprey, from a foot to eighteen inches long; silvery, with blackish or olive spots on the back; two large teeth in the maxillary ring; found in the fresh waters. *P. planerii*, the Small River Lamprey, is eight or ten inches long, and has the colours and teeth of the preceding: it also inhabits the fresh waters. [The last two are often styled Lamperns.]

*Myxine*.—The members of this genus have but one tooth in the maxillary ring, which is entirely membranous; two rows of strong teeth on each side of the tongue; but in other respects like the Lampreys. The mouth is circular, with eight cirri, and has a spiracle on the upper margin which reaches the interior. The body is cylindrical, and furnished with one fin round the extremity of the tail. The intestine is straight, but simple, and plaited internally, and the liver has two lobes: no eyes are perceptible. Their eggs grow to a large size; they discharge so much mucus from the pores in their lateral line that if kept in a vessel of water they turn it into a jelly; they attack fishes in the same manner as the Lampreys, and they are divided into subgenera according to the number of their gill-openings.

*Heptratrema*, has seven on each side, like the Lampreys, and the only known species is from the South Sea.

*Gastrobanchus*, has a common canal to the gills on each side, each of which opens by a hole near the heart, and at one third of the length from the head. *G. glutinosa*, the Hag, is the only known species, and it enters the mouths of fishes when on the fishermen's line, and plunders their substance.

*Ammocetes*, has the entire skeleton so soft and membranous that there is not a bone in the whole, not even a tooth; they have the external form and gill-openings of the Lampreys, but their fleshy lip forms only a semicircle on the upper part of the mouth, which is furnished with numerous cirri. The known species, *A. branchialis*, is from six to eight inches long, about the thickness of a goose-quill, and of no use but as bait for other fish. [It has been accused of sucking the gills of other fishes, but perhaps falsely. It is found in the sand and mud of small streams; preys on worms, insects, and dead matter, and is, in return, preyed on by the Eel.]

[*Amphioxus*, has the body compressed, the surface without scales, and both ends pointed. It has a dorsal along the whole line of the back, but no other fins. The mouth is on the under side of the body, opens longitudinally, and has a row of filaments on each side. *A. lanceolatus*, the Lancelet, is the only known species. It is a

## SECOND GREAT DIVISION OF THE ANIMAL KINGDOM.

## THE MOLLUSCA.\*

THE MOLLUSCA have no articulated skeleton nor vertebral canal. Their nervous system does not unite in a spinal cord†, but merely in a certain number of medullary masses dispersed in different points of the body, the principal one of which, called the brain, is placed crosswise upon the gullet, encircling it with a nervous collar. Their organs of motion and of the senses have not the same uniformity in number and position as in the Vertebrated Animals; and the variety is still more striking with the viscera, particularly in relation to the position of the heart and respiratory organs, and even in the structure and nature of the latter; for some Mollusca breathe the free air, and others the fresh or salt water. In general, however, their external organs, and those of locomotion, are symmetrical on the opposite sides of a middle axis.

The circulation of the Mollusca is always double,—that is to say, their pulmonary circulation always makes a separate and complete circuit; and this function is always aided by one fleshy ventricle at least, placed, not as in the Fishes, between the veins of the body and the arteries of the lung, but, on the contrary, between the veins of the lung and the arteries of the body. It is, consequently, an aortic ventricle. The family of Cephalopods alone is provided, besides, with a pulmonary ventricle, which is even divided into two. The aortic ventricle is also divided in some genera, of which the *Arca* and *Lingula* are examples: at other times, as in the remaining bivalves, its auricle only is divided.

When there is more than one ventricle, they are not united together to form a single organ, as in animals with warm blood, but they are often placed considerably apart, so that we may say that then there are several hearts.

The blood of the Mollusca is white, or bluish; and the fibrine appears to be proportionally less abundant than in the blood of Vertebrated Animals. There is reason to believe that their veins perform the functions of absorbent vessels.

Their muscles are attached to different points of their skin, and form there tissues more or less complicated and close in texture. The motions of these tissues are limited to contractions in different directions, which produce inflexions and prolongations, or relaxations, of their different parts; by means of which the creatures creep, swim, and seize upon various objects, according as the forms of the parts are adapted to these movements; but as their members are not sustained by jointed and solid levers, the Mollusca cannot make rapid springs.

The irritability of the greater number of the Mollusca is very great, and is retained

\* In the original, there is here a long note, containing an exposition of the Linnean classification of avertebrated animals, and also the modification of it proposed by Brugulbres. Cuvier's first sketch of the arrangement now to be explained was made in May 1795.—Ed.

† From this mode of expression, we infer that Cuvier had adopted the theory, that the brain and spinal cord are the result of a union of the nerves, trending from the circumference to certain centres. The opposite opinion was that maintained by Haller, and all the earlier physiologists.—Ed.

a long time in parts after they have been amputated. Their skin is naked, very sensitive, and, in general, bedewed with a humour, which oozes from its pores. No peculiar organ of smell has yet been discovered, although they enjoy that sense; and it may be that the entire skin is its seat, for this has much resemblance to a pituitary membrane. All the Acephales, the Brachiopods, the Cirrhopods, and some of the Gasteropods and Pteropods, are destitute of eyes; but the Cephalopods possess these organs, with a structure equal, at least, in complexity, to those of animals with warm blood. They also are the only Mollusca in which organs of hearing have been detected, and in which the brain is inclosed in a particular cartilaginous skull.

Nearly all the Mollusca have a developement of the skin which covers the body, and resembles more or less a *cloak*, but which is often reduced into a simple disk, or is folded into a tube, or hollowed into a sac, or, lastly, extended and divided in the form of fins or swimmers.

We call those *Mollusca naked* in which the cloak is simply membranous or fleshy; but there is commonly formed within it one or several laminae of a more or less solid substance, which is deposited in layers, and increases at the same time in extent, as well as in thickness, because the recent layers always extend beyond the older ones.

When this substance lies concealed in the cloak, common usage allows us to extend to the species so circumstanced, the title of *naked Mollusca*. But oftener that substance assumes such a size and developement that the animal can contract or withdraw under its shelter; we then give it the name of *shell*, and the animal is said to be *testaceous*. The skin which covers the shell is thin, and sometimes dried, or wanting: it is commonly called [by French naturalists], the *drap-marin*, [and by the English, and those who write in the Latin tongue, the *epidermis*].\*

The variety in the forms and colour, in the exterior sculpture, composition, and lustre of shells, is infinite. The greater number by far are calcareous; there are some simply corneous; but all are formed of material deposited in layers, or exuded by the skin under the epidermis, as are the rete mucosum, the nails, the hair, the horns, the scales, and even the teeth. The texture of shells differs according as that exudation is made in parallel layers, or in vertical filaments arranged closely against each other.†

The Mollusca present every kind of mastication and deglutition: their stomachs are sometimes simple, sometimes multiplicate, often furnished with peculiar armatures, and their intestines are variously elongated. They have, in general, salivary glands, and always a liver of considerable size, but no pancreas‡ nor mesentery. Several have secretions, which are peculiar to them.

They exhibit, also, every variety of generation. Several fecundate themselves, while in others, although hermaphrodite, the union of two individuals is necessary to fecundation: in many the sexes are distinct and separate. Some are viviparous; others are oviparous, and the eggs of these are sometimes enveloped in a more or less consistent shell, or sometimes only in a simple viscosity.

These variations in digestion and generation are found in Mollusca of the same order, sometimes of the same family.

The Mollusca, in general, seem to be animals of inferior developement: hebetous

\* Previous to my system, the Testacea were considered a peculiar order; but the transitions from the naked to the shelled Mollusca are so insensible, and their natural divisions are so interlaced, that this distinction can be no longer retained. Moreover, there are several Testacea which are not Mollusca.

† The student will find the formation of shells, and their structure, admirably explained by Mr. Gray, in a paper, on the economy of Molluscan animals, inserted in the *Phil. Trans.*, 1833.—Ed.

‡ Professor Grant maintains that there is a pancreas, or its representative, in all classes of Mollusca.—Ed.

and incapable of active exertion, they maintain themselves amid living beings principally by their fecundity, and the tenacity with which they retain life.

DIVISION OF THE MOLLUSCA INTO SIX CLASSES.\*

The general form of the body of the Mollusca being, in a sufficient degree, proportional to the complication of their internal organization, indicates their natural divisions.

In some, the body has the form of a sac, inclosing the branchiæ, and open above, whence there protrudes a head well developed, and crowned with certain strong fleshy elongated productions, by means of which the animals progress, and seize upon objects. We call these the CEPHALOPODES.

In others, the body is not open; the head has no appendages, or only very minute ones; the principal organs of locomotion are two wings, or membranous fins, placed on the sides of the neck, and in which the branchial tissue is often spread. These are the PTEROPODES.

Others, again, crawl on the belly on a fleshy disk, sometimes, though rarely, compressed into a fin. They have almost all a distinct head. We call these the GASTEROPODES.

A fourth class is composed of those Mollusca in which the mouth lies concealed in the base of the cloak, which also incloses the branchiæ and the viscera, and opens either throughout its whole length, or at both its extremities, or at one only. These are our ACEPHALES.

A fifth comprehends the species which, inclosed also in a cloak, and without an apparent head, have fleshy or membranous arms, garnished with ciliæ of the same nature. We have called these the BRACHIOPODES.

Lastly, there are some which, alike the other Mollusca in the cloak, the branchiæ, &c., differ from them in having numerous horny articulated members, and in a nervous system more allied to that of the Annulose Animals. Of these we constitute our last class, the CIRRHOPODES.

THE FIRST CLASS OF MOLLUSCA.

THE CEPHALOPODES.\*

The cloak unites under the body, and forms a muscular sac, that incloses all the viscera. In several species, its sides are extended into fleshy fins. The head issues from the opening of the sac: it is roundish, furnished with two large eyes, and crowned with fleshy conical arms or feet, varying in their length, and capable of being bent very vigorously in every direction; and, as their surface is armed with suckers, the animals fix themselves, by their means, with great force to whatever objects they embrace. With their feet they seize their prey, walk, and swim. They swim with the head backwards, and crawl in all directions, with the head beneath and the body above.

\* For the name *Mollusca*, M. de Blainville proposes to substitute *Malacozoa*; and he separates from them the Chitons and the Cirrhopods, with which he makes a subtypical section under the name *Malacozoa*. The following distribution of the Mollusca into

classes is entirely my own, as well as the greater number of the subdivisions to the second degree.

† The *Cephalopoda* of De Blainville.



A fleshy funnel placed at the aperture of the sac, before the neck, affords an outlet to the excretions.

The Cephalopodes have two branchiæ, one on each side of the sac, in the shape of a compound fern-leaf. The great vena cava, when between them, divides into two branches, which terminate each in a fleshy ventricle, placed at the base of its respective branchia, and propelling the blood into it.

The two branchial veins tend to and terminate in a third ventricle, situated near the bottom of the sac, whence the blood is carried to every part of the body by different arteries.

Respiration is effected by the water which enters into the sac, and is driven out again through the funnel. It appears that the water even penetrates into two cavities of the peritoneum, which the venæ cavæ cross in their course to the branchiæ; and that it has some influence on the venous blood, through the medium of a glandular apparatus attached to these veins.

The mouth opens amidst the bases of the feet. It has two powerful corneous jaws, similar to the beak of a Parrot, and between the jaws is a tongue roughened with horny prickles. The gullet swells out into a crop, and then passes into a gizzard as fleshy as that of a bird, to which succeeds a third membranous and spiral stomach, into which the liver, which is very large, pours its bile through two conduits. The intestine is simple and short. The rectum opens into the funnel.

These animals have a peculiar excretion of a deep black colour, which they use to taint the water when concealment is necessary. It is secreted by a gland, and reserved in a sac, differently situated in different species.

Their brain, inclosed in a cartilaginous cavity of the head, sends off from each side a cord which swells, within each orbit, into a large ganglion, whence are derived innumerable optic filaments. The eye is formed of numerous membranes, and is covered by the skin, which becomes transparent in passing over it, and sometimes forms folds that supply the want of eyelids. The ear is merely a little cavity excavated on each side near the brain, without semicircular canals or external passages, and in which there is suspended a membranous sac, containing a little stone.

The skin of these animals, particularly of the Octopus, changes colour, in patches and in spots, with a rapidity greatly superior to that of the Chameleon.\*

The sexes are separate. The ovary of the female is at the bottom of the sac. Two oviducts carry the eggs from it, passing them through two large glands which envelope them, during their passage, with a viscous fluid, and gather them together into a sort of cluster. The testicle of the male, similar in position to the ovary, gives off a vas deferens that terminates in a fleshy penis situated to the left of the anus. A vesicula seminalis, and a prostate, also open there. There is reason to believe that impregnation is effected by a sprinkling of the seminal fluid over the eggs, as illustrated in the majority of Fishes. In the season of spawning, the vesicula contains a vast number of little filiform bodies, which, through a peculiar mechanism, writhe and move about rapidly as soon as they fall into the water, and shed the fluid with which they are filled.

These animals are voracious and savage; and as they are agile, and are furnished

\* See Cuvier, *Nov. Act. Nat. Cur.* xii. part 1. p. 330; and Sangiovanni, *Ann. des Sci. Nat.* vol. xvi. p. 308. [Also Coldstream, in *Edinburgh Journ. of Nat. and Geograph. Science*, vol. ii. p. 206.]

with numerous organs for seizing their prey, they destroy many Fishes and Crustaceous animals.

Their flesh is eatable. Their inky secretion is employed in painting, and from it some have asserted that the China ink of commerce is manufactured.\*

The Cephalopods comprise only one order†, which we divide into genera from the nature of the shell. Those which have no external shell formed, according to Linnæus, the single genus

SEPIA, or CUTTLE-FISH,‡

which we now subdivide as follows:—

THE POULPES (*Octopus*, Lam.); the *Polypus* of the ancients.

These have only two small conical grains of a horny substance imbedded in their back, one on each side; and their sac, having no fins, represents an oval purse. Their feet are eight in number, all nearly of equal size, very large in proportion to the body, and united together at their insertions by a membrane. The *Octopus* uses them equally in swimming, in creeping, and in seizing its prey. From their length and strength they are formidable weapons, by means of which the prey is entangled and caught; and they have often been the destruction of swimmers.§ The eyes are proportionally small, and the skin can be made at will to contract over them so as to cover them completely. The ink bag is embedded in the liver. The glands of the oviducts are small.

Some (the *Polypes* of Aristotle) have their suckers in two alternating rows along [the oral margin] of each foot. The common species (*Sepia octopodia*, Linn.), with a minutely granulous skin, arms six times as long as the body, and garnished with 120 pairs of suckers, infests our coasts in summer, where it destroys an immense quantity of Crustacea. The seas of the tropics produce the *Octopus granulatus*, Lam. (*Sepia rugosa*, Bosc.) *Seb.* iii. ii. 2, 3, known by its more decidedly granulated body, its arms only a little longer than itself, garnished with fifty pairs of suckers. Some believe this to be the species which furnishes the China ink of commerce.

Other Poulpes (the *Eledons* of Aristotle) have only a single row of suckers down each foot. In the Mediterranean there is a species remarkable for its musky smell: it is the *Octopus moschatus*, Lam.—*Mém. de la Soc. d'Hist. Nat.* in 4to, pl. 11; *Rondelet*, 516.

THE ARGONAUTS (*Argonauta*, Linn.)—

Are Poulpes with two rows of suckers: the pair of feet nearest the back expand, at their extremities, into a broad membrane. They have not the dorsal cartilaginous spicula of the common *Octopus*; but

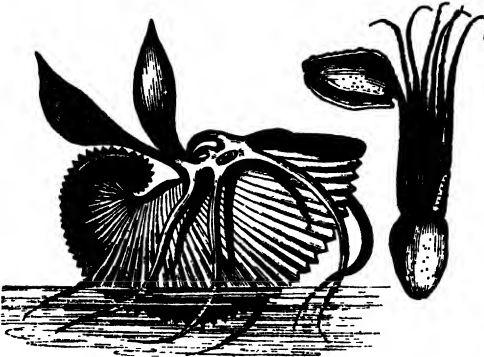


Fig. 161.—Argonauta.

we always find these Cuttles in a very thin, regularly-grooved spiral shell, which, from the disproportionate size of the last whorl, has some resemblance to a canoe, the spire representing the poop. The animal uses it too as a boat, for when the sea is calm, groups of them have been seen navigating the surface in it, employing six of their tentacula for oars, and raising, it is said, the two with expanded extremities to serve the purposes of sails. If the waves rise, or any danger threatens, the Argonaut withdraws all its arms into the shell, contracts itself there, and descends to the bottom. Its body does not penetrate within the spire of the shell, and it appears does not adhere to it,

at least there is no muscular attachment, and this fact has led some authors to think that the Cuttle is a parasite of the same nature as the Hermit-crab ||; but as it is always found in the same shell, as we never find any other animal there, although it is very common, and naturally adapted for rising to the

\* However, M. Al. Remusat has found nothing in Chinese authors to confirm this opinion, [which, the translator may add, is now known to be erroneous].

† The discoveries of Mr. Owen have proved the necessity of dividing the class into two orders.—1. *Dibranchiata*, with two branchia, of which all the naked Cuttle-fish are examples; and, 2. *Tetrabranchiata*, with four branchia, as in *Nautilus*, and as supposed to have been in the multilocular-shelled fossil Cephalopodes.—Ed.

‡ In Blainville's system they form the order *Cryptodibranchiata*.

§ This fact needs confirmation; and we need scarcely add, that the stories of their sinking boats and ships are entirely fabulous.—Ed.

|| Hence M. Rafinesque, and others following him, have made the animal a genus under the name *Ocythoe*. [Certainly the opinion of its being a parasite was, until recently, entertained by most naturalists; but that advocated by Cuvier has been greatly strengthened, or rather proved, by the experiments of Mrs. Power. See the *Mag. of Natural History*, conducted by Mr. Charlesworth; and the dissections and arguments of Mr. Owen, in the *Proceedings and Transactions of the Zoological Society of London*. The animal does not sail as here described: the use of the expanded arms is to retain the animal within its shell.]

surface, and as it has been even asserted that the germ of this shell has been seen in the egg of the Argonaut\*, we must say that this opinion is, to say the most of it, still very problematical.—Poli, *Testac. Neap.* iii. p. 10. See also Ferussac, *Mem. de la Soc. d'Hist. Nat. de Paris*, ii. p. 160; and Ranzani, *Mem. di Stor. Nat. Lec.* i. p. 85. It is the *Nautilus* and *Pompilus* of the ancients.—*Plin.* ix. c. 29.

We know some species, very like each other both in the animal and shell, which Linnæus confounded together under the name of *Argonauta argo*, vulgarly called the *Paper-nautilus*.

It is supposed that we must ascribe to an animal analogous to the Argonaut, the *Bellerophon*,—fossil shells rolled up spirally and symmetrically, and without septa; but thick, not grooved, and whose last whorl is proportionably shorter. [Sowerby says that *Bellerophon* is the only fossil that bears any real resemblance to *Argonauta*, but neither shell, in his opinion, has been formed by a Cephalopodous animal, but probably by one nearly like that of *Carinaria*. The fossils are characteristic of the carboniferous limestone, and the oldest secondary strata: in these the shell is frequently found changed to silex.]

#### THE SLEEVE-FISH (*Loligo*, Lam.)—

Have in the back, instead of a shell, a horny lamina in the shape of a sword or lancet. Their sac has two fins; and besides the eight feet, furnished with small pedicled suckers inordinately arranged, their head supports two arms much longer than the feet, and only acetabuleferous near the ends, which are enlarged. These the animal employs as anchors to fix itself. Their ink-bag is buried in the liver; and the glands of their oviducts are very large. They lay their eggs attached together in straight garlands, and in two series; [and the entire mass somewhat resembles a mop, being composed of numerous intestine-like filaments tied together in the centre].

The family is now subdivided from the number and armature of the feet, and the form of the fins. The *Loligopsis*, like the Octopus, has only eight feet, but our knowledge of the genus rests upon figures that are scarcely trustworthy.† In *Loligo* properly so called, the arms have suckers as well as the feet, and the fins are situated towards the end of the sac. We have three species in our seas,—the *L. vulgaris* (*Sepia loligo*, Linn.); *L. sagittata*, and *L. subulata*, or *Sepia media*, Linn. The *Onychoteuthis*, Lichenst. (*Onykia*, Lesueur,) have the form of the *Loligo*, but the suckers of their arms end in hooked spines. The *Sepiola* have rounded fins, attached, not to the end, but to the sides of the sac. The common *Sepiola* (*Sepia sepiola*, Linn.) occurs in our seas. The body is short and obtuse, with small circular fins. It never exceeds three inches in length; and its horny lamina is slender and pointed like a needle.‡ The *Sepiotheutes*, Blainv. (*Chondrosepia*, Leukard,) have the sac margined throughout with the fins, as in the *Sepia*; but their shell is horny, as in the *Loligo*.

#### THE CUTTLE-FISH, strictly so called (*Sepia*, Lam.)—

Possess the two long arms of *Loligo*, and a fleshy fin stretched along each side of their sac. Their shell is oval, thick, tumid, and composed of an infinity of very thin parallel calcareous laminæ, joined together by thousands of little hollow columns, which are placed upright in the spaces between every two laminæ. This structure renders it friable, whence it is employed by artists in polishing various works; and it is given to cage birds to sharpen their beaks upon. The *Sepia* have the ink-bag separate from the liver, and situated deeper in the abdomen. The glands of the oviducts are enormously large. They deposit their eggs attached to one another in branched clusters, not unlike a cluster of grapes, whence the vulgar have called them *Sea-grapes*.

The species distributed in all our seas (*Sepia officinalis*, Linn.) reaches a foot or more in length. Its skin is smooth, whitish, and dotted with red. In the Indian Ocean there is one with a skin roughened with tubercles (*S. tuberculata*, Lam.).

(Among fossils we find some little bodies armed with a spine, which are the ends of a bone of *Sepia*. They constitute the genus *Beloptera* of Deshayes. See *Ann. des. Sc. Nat.* ii. xx. 1, 2. Some other fossils, but petrified, appear to have great relation to the beaks of the *Sepia*. These are the *Ryncholithes* of M. Faure Biguet.—See Gaillardot, *Ann. Sc. Nat.* ii. 483, and pl. xxii.; and D'Orbigny, ib. pl. vi.)

Linnæus united in one genus—his

#### NAUTILUS—

All spirally twisted, symmetrical, and chambered shells,—that is to say, divided by partitions into several cavities; and he supposed them to be inhabited by Cephalopods. One of them is, in fact, the shell of a Cephalopod, very similar to a *Sepia*, but with shorter arms: it is the genus

#### SPIRULA, Lam.—

In the hinder part of the body of the Cuttle is an interior shell, which, however dissimilar to the bone of the *Sepia* in figure, does not differ much from it in the manner of its formation. If we imagine



Fig. 182.—Eggs of the Argonaut.

\* This appears now to have been disproved.—Ed.

† *Loligopsis* is now ascertained to have two arms, remarkable for their great length and gracility.—See Ferussac, in *Ann. des Sciences*

*Nat. Part. Zool.* n. s. iii. p. 330, &c.—Ed.

‡ On the anatomy of *Sepiola* and *Loligopsis*, consult Dr. Grant's paper in the 1st vol. of the *Zool. Trans.*—Ed.

that the successive layers, instead of remaining parallel and in high approximation, were to become concave towards the body, more distant, each growing a little in breadth, and making an angle between them, we should then have a very elongated cone, rolled up spirally on one plane, and divided transversely into chambers. Such is the shell of *Spirula*; which has these additional characters, that the turns of the spire do not touch, and that a single hollow column, occupying the interior side of each chamber, continues its tube with those of the other columns even to the extremity of the shell. This is what is named the *Syphon*.

Only one species (*Nautilus spirula*, Linn.) is known.

The shell of the *Nautilus*, properly so called, differs from that of the *Spirula* in this,—that the septa increase very rapidly, and that the last turns of the spire not only touch, but envelope the preceding. The syphon is in the centre of each partition. The common species (*Nautilus pompilius*, Lin.) is very large, silvered within, and covered externally with a whitish crust, varied with reddish somewhat undulated bands. According to Rumphius, its animal should be in part lodged in the last cell, and should have the sac, the eyes, the parrot-like beak and the funnel of other Cephalopods; but its mouth, instead of their great feet and arms, should be surrounded with several circles of numerous little tentacula, destitute of suckers. A ligament springing from the beak should run through the syphon, and fix the animal to it. It is probable also that the epidermis is prolonged over the exterior of the shell; but we may conjecture that it is thin upon such parts as are vividly coloured.\*

We meet with specimens of *Nautilus* (*N. pompilius*, B. Gm. List. 552; *Ammonia*, Montf. 74), in which the last whorl does not envelope nor conceal the others, but in which all the whorls, although they touch, are visible,—a character which approximates them to the *Ammonites*; yet in every other respect they so closely resemble the common species that it is difficult to believe they are not a variety of it.

Among fossils there are *Nautili* of large and moderate sizes, and of figures more varied than now exist in the ocean.

We also find fossils certain chambered shells, with simple septa and a syphon, in which the body is at first arched, or even spiral, but the last-formed parts of it are straight: these are the *Litua* of Breyn, in which the whorls are either contiguous or separate, (the *Hortoles*, Montf.)—Others remaining straight throughout their growth are the *Orthoceratites*. It is not improbable that their animals had some resemblance to that of the *Nautilus*, or to that of the *Spirula*.

#### THE BELEMNITES

Belong, probably, to the same family, but it is impossible to be sure of this, since they are only found in a fossil condition. Their whole structure, however, shows that they were internal shells.† They have a thin and double shell, that is to say, composed of two cones, united at their base, and the interior of which, much shorter than the other, is itself divided internally into chambers by parallel septa, concave on the side that looks to the base. A syphon extends from the summit of the exterior cone to that of the internal cone, and is continued hence, sometimes along the margin of the septa, and sometimes through their centre. The space between the two testaceous cones is filled with a solid substance, composed either of radiating fibres or of conical layers, which envelope each other, and each of which rests on the margin of one of the septa of the inner cone. Sometimes we find only this solid part; at other times we find also the nuclei of the chambers of the inner cone, or what has been called the *alveolæ*. Oftener these nuclei, and even the chambers, have left no other traces behind than some projecting circles within the inner cone; and in other instances, the *alveolæ* are found in greater or less numbers, and still piled or strung together, but detached from the double conical case which had inclosed them.

The *Belemnites* are amongst the most abundant of fossils, particularly in beds of chalk and compact limestone. The most complete works upon them are the *Memoire sur les Belemnites considerées zoologiquement et geologiquement*, by Blainville, Paris, 1827; and that of M. I. S. Miller on the same subject, in vol. ii. part 1, of the *Geological Trans.*, Lond., 1826. [The English student will find the fullest details in Buckland's *Bridgewater Treatise*.] M. de Blainville distributes them from characters derived from the greater or less depth to which the inner cone, or chambered part, penetrates; from the margins of the external cone, which has, or has not, a small



Fig. 163.—Belem

\* The structure of this singular Cephalopod has been fully described and illustrated in a very admirable manner, by Mr. Owen, in his "*Memoir on the Pearly Nautilus*," Lond., 1832.—Ed.

† It may give the student an idea of the nature of the evidence on

which fossils are occasionally referred to living types, to mention that Raspail believes the *Belemnites* to be the cutaneous appendages of some sea animal, perhaps allied to the Sea-urchin, (*Echinus*).—Ed.

fiassura; from the exterior surface being marked with a longitudinal gutter on one side, or with two or several gutters towards the summit; or as that surface is smooth and without gutters.

Some fossils, very much like the Belemnites, but without a cavity, and even with a protruding basis, form the genus *Actinocamax* of Miller.

It is upon similar conjectures that the classification of the

#### AMMONITES, Brug., or SNAKE-STONES,—

Is founded, for they, also, are only found in a fossil state. They are distinguished, in general, from *Nautilus*, by their septa, which, instead of being plain or simply concave, are angulated, sometimes

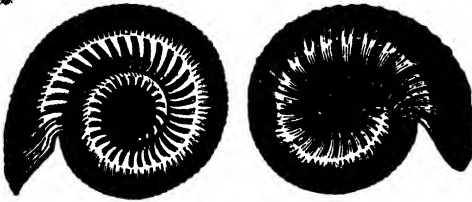


Fig. 154.—Ammonites

undulated, but oftener gashed on the margins, like the leaves of the *Acanthus*. The smallness of their last cell leads to the belief that, like the *Spirula*, they were internal shells. The beds of the secondary mountains swarm with them, and we find them there from the size of a bean to that of a chariot wheel. The variations of their whorls and of their syphon enable them to be subdivided. Thus the name

*Ammonites*, Lam., is restricted to the species in which all the whorls are visible. Their syphon is near the margin. They have been still further distinguished into those which have the margins of the septa foliaceous, (the *Ammonites*, the *Planites* of Haan), and into those in which they are simply angular and undulatory (the *Ceratites* of Haan). Those in which the last whorl envelopes all the others, are the *Orbulites*, Lam., or the *Globites* and *Goniatites* of Haan, or *Pelaguses*, Montf. The syphon is the same as in *Ammonites*.\* The name *Scaphites*, Sowerby, [or rather of Parkinson,] has been appropriated to those species whose whorls are contiguous and on the same plane, excepting the last, which is detached and bent upon itself. Those which are perfectly straight are the *Baculites*, Lam. Some are round, others are compressed; and in the latter we sometimes observe the syphon to be lateral. The *Hamites* of Sowerby, [Parkinson,] are known by having their first formed cells arcuated. But the *Turritites*, Montf., differ more than any from the usual habit of the family, for the whorls, in place of remaining on the same level, descend rapidly, and give to the shell that obelisk form which is denominatd turriculated.



Fig. 155.—Portion of a Baculite

From analogy, it is supposed that we ought to the Cephalopoda, and to consider as being internal shells

#### THE CAMERINES, Brug. (*Nummulites*, Lam.),—

For all of them are equally fossil. They have a lenticular shape, without any apparent aperture, but within there is a spiral cavity, divided by septa into a multitude of little chambers without a syphon. They are amongst the most generally diffused fossils, and almost of themselves form some entire chains of calcareous hills, and immense banks of building stone. (It is upon such rocks that the pyramids of Egypt are founded, and with stones of the same description that they are built.)

The commonest, and which attains the largest size, are altogether discoid, and have only a single row of chambers in the whorl of the spire. Some minute sorts of this description have been also found recent in some seas. Other minute species, both living and fossil, have their margin bristled with points, which give to them the figure of stars (*Siderolithes*, Lam.).

The works and the patient researches undertaken successively by Bianchi (or *Janus Planicus*), Soldani, Fichtel and Moll, and Alex. d'Orbigny, have made known an astonishing number of these chambered and esyphonal shells (*Nummularie*), of extreme littleness, so as often to be altogether microscopical, either in the sea, among sand, sea-weed, &c.; or, in a fossil state, in the sand-beds of various countries; and these shells vary to a remarkable extent in their contour, the number and the relative position of their chambers, &c. One or two species, the only ones in which the animals have been noticed, have, apparently, a small oblong body surmounted by numerous red tentacula, a structure which, taken in

\* According to Sowerby, *Orbulites* and *Ammonoceras*, of Lamarck, are not distinct from *Ammonites*. The *Ammonoceras* is only an accidentally worn portion of an *Ammonite*.—Ed.

connection with the septa of their shells, has occasioned them, like the genera which we have just treated of, to be arranged in the series of Cephalopods; but this classification requires to be confirmed by more numerous observations before it can be considered as settled.\* Linnæus and Gmelin placed the species known in their time in the genus *Nautilus*. M. d'Orbigny, who has studied them more carefully than any one else, makes an order of them, which he calls *Foraminifères*, because the cells communicate only by holes; and he divides them into families from the manner in which the cells are arranged. When the cells are simple, and disposed spirally, the shells constitute his *Helicostegues*, which are subdivided; for, if the whorls of the spire envelope each other, as is particularly the case with the Camerines, he names them *Helicostegues nautiloides*; if the whorls do not cover themselves, they are *H. ammonoides*; and if the whorls rise up, as in the greater number of univalves, they are his *H. turbinoides*. The family *Stycostegues* is known by the simple cells being, as it were, threaded on a single straight, or slightly curved axis. When the cells are disposed in two alternate rows, they are then the *Enalllostegues*. If the cells are gathered together in small numbers, and heaped up in a globular shape, the family is the *Agathistegues*. Lastly, in the *Entomostegues*, the cells are not simple, as in the preceding families, but are subdivided by transverse partitions, so that a section of the shell discovers a sort of trellis-work.

## THE SECOND CLASS OF MOLLUSCA.†

### THE PTEROPODES.

They swim, like the Cephalopods, in the sea, but cannot fix themselves there, nor creep, from want of feet. Their organs of locomotion consist of fins only, placed at each side of the mouth. The species known are of small size, and few in number. They are all hermaphrodites.

THE CLIO (*Clio*, Linn.; *Clione*, Pall.)—

Have an oblong membranous body, without a cloak; the head is formed of two rounded lobes, whence the little tentacula project; two small fleshy lips, and a tongue, upon the front of the mouth; and the fins contain the vascular network which supplies the place of branchiæ; the anus, and the orifice of generation, are under the right branchiæ. Some have asserted the existence of eyes. The viscera do not nearly fill the exterior envelope. The stomach is large, the intestine short, and the liver voluminous.

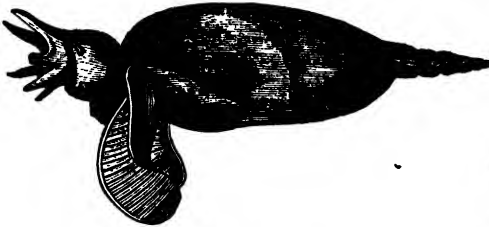


Fig. 156.—*Clio borealis*.

The most celebrated species (*Clio borealis*, Linn.) swarms in the northern seas; and, from its abundance, becomes a food for the Whales, although no individual exceeds an inch in length. Bruguière has observed a larger species, in equal abundance, in the Indian Ocean. It is distinguished by its rose-colour, its emarginate tail, and its body separated into six lobes by as many grooves.

It seems that we must also place here the

CYMBULIA of Peron,—

Which has a cartilaginous or gelatinous envelope in the shape of a boat, or rather of a shoe, roughened with little points arranged in longitudinal rows. The animal has two large vascular wings, which are its branchiæ and its fins; and between them, on the open side, there is a third lesser lobe with three points. The mouth, with two small tentacula, is between the wings, towards the closed side of the shell; and above are two minute eyes, and the orifice of generation, whence issues a penis in the form

\* Some of these multilocular shells belong apparently to the testaceous Annelides; while the curious observations of Dujardin seem to have proved that the great bulk of the Foraminifères are not Mollusca, but animals related to the Infusoria.—*Ann. des Sci. Nat.* v. vol. v. et seq.—Ed.

† M. de Blainville unites my Pteropodes and Gasteropodes into one class, which he calls *Paracéphalophora*, of which my Pteropoda constitute his order *Aporobranchiata*. This order he divides into two families:—The *Thaecosomata*, which have a shell; and the *Gymnosomata*, which are shell-less.

- of a little beak. The transparency of the body allows us to distinguish the heart, the brain, and the viscera, through the envelopes.

#### THE PNEUMODERMES (*Pneumodermos*, Cuv.)—

Carry their dissimilarity to the *Clio*s a little further. The body is oval, without cloak or shell; the branchiæ attached to the skin, and formed of little leaflets set in two or three lines, disposed in the figure of the letter H opposite to the head; the fins small; the mouth (garnished with two small lips, and two bundles of numerous tentacula, terminated each by a sucker) has underneath a small lobe, or fleshy tentaculum.

The only species (*P. Peronii*, Cuv.) was taken in the ocean by Peron. It is not less than an inch in length.

#### THE LIMACINÆ, Cuv.,—

Ought, from the description of Fabricius, to have a nigh relationship to *Pneumodermos*; but their body is terminated with a spiral tail, and is lodged in a very thin shell, of one whorl and a half, umbilicated on one side,\* and flat on the other. The shell serves the purpose of a boat; and when the creature wishes to swim on the surface, it uses its fins as oars.

The species known (*Clio helicina* of Phipps and of Gmel.; *Argonauta arctica*, Fabr., *Favn. Greenl.* 387) is not less abundant than the *Clio borealis*, in the Arctic seas; and is likewise a principal aliment of the Whale.

#### THE HYALES (*Hyalea*, Lam.; *Cavolina*, Abildg.)—

Have two very large wings; no tentacula; a cloak slit on the sides, containing the branchiæ at the bottom of the fissures, and clothed with a shell slit in a corresponding manner, the ventral aspect of which is very tumid; the dorsal aspect is flat, longer than the other, and the transverse line which unites them behind is furnished with three acute denticulations. When alive, the animal protrudes, through the chinks of the shell, certain narrow filaments, or productions of the cloak, of variable lengths.

The best known species (*Anomia tridentata*, Forskahl; *Carolina natans*, Abildgaard; *Hyalea cornea*, Lam.) has a small yellowish semi-transparent shell, and is found in the Mediterranean and the Indian Ocean.

#### THE CLEODORES (*Cleodora*, Peron).

For these, Brown first instituted the genus *Clio*. They appear to be analogous to the *Hyales* in the simplicity of their wings, and the absence of tentacula between them. It is also probable that their gills are concealed in the cloak; but their conical or pyramidal shell is not slit along the margins.

M. Rang distributes the genus into subgenera thus:—*Cleodora*, with the shell pyramidal; *Creseis*, with the shell conical, elongated; *Cuvieria*, with the shell cylindrical; *Psyche*, the shell globular; *Euribia*, the shell hemispherical. (And it is probable that we should arrange near the *Creseis*, and even perhaps in the same subgenus, the *Triptet* of Quoy and Gaimard, which Blainville has referred to the family *Aceræ*.)

It has been believed that we may place near to the *Hyales*,—

#### THE PYRGO,—

A very small fossil shell discovered by M. DeFrance. It is globular, very thin, and divided by a very narrow transverse fissure, excepting in front, where it becomes also a little enlarged.

(Several *Pteropodes* have been discovered in the fossil state. M. Rang has found, in the *terrains* of Bordeaux, *Hyales*, *Cleodora*, and *Cuvieria*.—See *Ann. des Sci. Nat. for August 1826*. The *Vaginula* of Daudin is a *Creseis*, according to Rang; and it has, in fact, all the characters of the same.)

### THE THIRD CLASS OF MOLLUSCA.

#### THE GASTEROPODES.

The *Gasteropods* constitute a very numerous class, of which the Slug and the Snail give a good general idea. They creep generally upon a fleshy disk, situated under the belly, but which sometimes assumes the form of a furrow, or of a vertical lamina. The back is covered with a cloak of greater or less extent, and of various figure, which secretes a shell in the greater number of the genera. Their head, placed in front, is more or

\* Sowerby says, "Umbilicated on both sides."—Ed.

less distinct, according as it is more or less drawn in under the cloak. It is furnished with tentacula of [comparatively] small size, and which do not encircle the mouth; their number varies from two to six, but they are sometimes wanting; they are organs of touch, and, at most, of smell also. The eyes are very small, sometimes placed upon the head, sometimes at its base, either to a side or at the tips of the tentacula; they are sometimes also wanting. The position, the nature, and the structure of their breathing organs vary, and afford characters whereby to divide them into several families; but they have never more than one aortic heart,—that is to say, one placed between the pulmonary vein and the aorta.

The position of the orifices of the organs of generation, and that of the anus, varies; but they are almost always on the right side of the body.

Several are entirely naked, others have only an interior shell, but the majority are covered with one which contains the soft body, and shelters it.

These shells are secreted in [or on] the cloak. Some of them consist of several symmetrical pieces [or valves]; some of a single symmetrical piece; and others of a non-symmetrical piece, and when this is very concave, or continues to grow for a long time, an obliquely spiral shell is necessarily produced. In fact, that the shell may represent an oblique cone, on which are placed successively other cones always wider in one direction than in the others, it is necessary that the whole should turn to the side which enlarges the least.

That part upon which the cone is turned is named the *columella* [or pillar], and it is sometimes full, and sometimes hollow. In the latter case, its opening is called the *umbilicus*.

The whorls of the shell may remain nearly on the same plane, or they may tend always towards the base of the columella. In this case, the preceding whorls rise above the others as they are formed, and constitute what is called the *spire*, which is acute in proportion to the rapidity with which the whorls descend, and to the measure of their increase. The shells with an elongated spire are said to be *turbinate*. When, on the contrary, the whorls remain depressed on the same level, and do not envelope each other, the spire is *flat*, or even *concave*. These shells are called *discoid*. When the upper part of each whorl envelopes or covers the preceding, the spire is *concealed*.

The place in the shell whence the animal protrudes itself, is named the *mouth*, or *aperture*.

When the whorls remain nearly on the same plane, the animal, in creeping, has its shell placed vertically, the columella transversely upon the hinder part of the back; and its head passes out under the margin of the mouth opposite to the columella. When the spire is turbinate, the whorls turn obliquely to the right side in nearly all the species, but in a small number to the left; and the latter are named *reversed*, [or *sinistrorsal*].

It is to be observed that the heart is always on the side opposite to that to which the spire is directed. It is, consequently, in general on the left, and only on the right in the reversed kinds. The contrary is the rule with the organs of generation.

The organs of respiration, which are always within the last whorl of the shell, receive the circumfluent element under its margin, sometimes because the cloak is detached from the body along the whole of this margin, and sometimes because it is perforated there with a hole. The margin of the cloak, in many Gasteropods, is prolonged into



a canal, through which they can reach and receive the circumfluent medium without extruding their head or foot from the shell. The shell has then, also, in its margin, near the end of the columella, opposed to that towards which the spire tends, an emargination, or furrow, wherein to lodge the canal of the cloak. Consequently, the canal is to the left in common, but to the right in the reversed species.

Further, the animal being very flexible, can vary the direction of the shell, and oftenest when there is an emargination or furrow, it directs the canal forwards, whence it happens that the spire points to behind, the columella to the left, and the opposite margin to the right. The contrary of this occurs in the reversed sorts: and this is the reason that we say that their shell turns to the left, [or is *sinistral*].

The mouth of the shell, and consequently also the last whorl, is greater or less, in relation to the other whorls, according as the head or the foot of the animal is more or less voluminous in relation to the mass of viscera which remains fixed within the shell; and the mouth is wider or narrower just as the same parts are more or less broad. There are shells whose mouth is narrow and long; and there it is that the foot is thin, and doubles on itself before it can be retracted.

The greater number of the aquatic Gasteropods with a spiral shell, have an *operculum*, or a corneous or calcareous plate, affixed upon the posterior part of the foot, to close the aperture when the snail has withdrawn within the shell.

There are Gasteropods with separate sexes, and others which are hermaphrodites; and of these some are capable of self-impregnation, while, in others, the copulation of two individuals is required.

Their organs of digestion do not vary less than those of respiration.

The class is so numerous that we have deemed it expedient to divide it into a certain number of orders, the characters of which we have drawn from the position and the form of the branchiæ.

#### THE PULMONEA •

Breathe the atmosphere, receiving the air within a cavity whose narrow orifice they can open and close at will: they are hermaphroditical, with reciprocal copulation: some have no shell, others carry one, which is often truly turbinate, but never furnished with an operculum.

#### THE NUDIBRANCHIATA

Have no shell, and carry their variously-figured branchiæ naked upon some part of the back.

#### THE INFEROBRANCHIATA

Are similar, in some respects, to the preceding, but their branchiæ are situated under the margins of the cloak.

#### THE TECTIBRANCHIATA

Have their branchiæ upon the back, or upon the side, covered by a lamina, or fold of the cloak, which almost always contains a shell more or less developed; or sometimes the branchiæ are enveloped in a narrow fold of the foot.

These four orders are hermaphroditical, with reciprocal copulation.

#### THE HETEROPODES 4

Carry their branchiæ upon the back, where they form a transverse row of little tufts, and are, in some instances, protected, as well as a portion of the viscera, by a symmetrical shell. What best distinguishes them is the foot compressed into a thin vertical fin, on the margin of which a little sucker often appears,—the only trace left of the horizontal foot of the other orders of the class.

THE PECTINIBRANCHIATA

Have the sexes separated: their respiratory organs consist almost always of branchiæ composed of lamellæ united in a pectinated form, and which are concealed in a dorsal cavity opening with a wide gape above the head. Nearly all of them have turbinated shells, with the mouth sometimes entire, sometimes emarginate, sometimes produced into a syphonal canal, and generally capable of being more or less exactly closed by an operculum attached to the foot of the animal behind.

THE SCUTIBRANCHIATA

Have branchiæ similar to those of the Pectinibranchiata, but they are complete hermaphrodites, and require no union with a second to effect impregnation: their shells are very open, and in several like a shield; they never have any operculum.

THE CYCLOBRANCHIATA

Are hermaphrodites of the same kind as the Scutibranchiata, and have a shell consisting of one or several pieces, but in no case turbate nor operculate: their branchiæ lie under the margin of their cloak, as in the Inferobranchiata.

THE FIRST ORDER OF GASTEROPODES.

THE PULMONEA.\*

From other Mollusca, those of this order are distinguished in this,—that they breathe the atmosphere through a hole which opens under the margin of their cloak, and which they can dilate or contract at pleasure. They have, also, no branchiæ, but only a network of pulmonary vessels, which creep upon the walls, and more particularly upon the ceiling of their respiratory cavity. Some of them are terrestrious, and others live in the water, but these are necessitated to come, from time to time, to the surface, to receive within their pulmonary cavity the air fit for respiration. All of them are hermaphrodites.

The TERRESTRIAL PULMONEA have almost all four tentacula, for, in a few only, of small size, we cannot see the inferior pair, probably because of their littleness.

Those of them which have no apparent shell, form the genus

LIMAX—

Of Linnæus, which is divided as follows:—The *Limacæ*, properly so called (*Limax*, Lam.), have an elongated body, and a closely-fitted fleshy disk, or shield, for a cloak, which occupies merely the anterior part of the back, and covers only the pulmonary sac. It contains, in several species, a small, oblong, flat shell, or at least, in lieu of it, a calcareous [molecular] deposition. The respiratory orifice is at the right side of the shield, and the anus opens near it. The four tentacula are pretruded and withdrawn by a process of evolution and involution; and the head itself can be contracted partially under the disk of the cloak. The orifice of the generative organs is under the right superior tentaculum. In the mouth is an upper jaw only, of a crescent form, and toothed, which enables them to devour with voracity herbs and fruits, to which they are very destructive. Their stomach is elongated, simple, and membranous.

M. de Ferussac distinguishes the *Arionæ* by the respiratory orifice being towards the anterior part of the shield, in which there are only calcareous granules. *Limax rufus*, Linn., is an example which we meet with every step in moist seasons, and which is sometimes almost wholly black. It is the species of which a broth is used in diseases of the chest. The *Limax* proper, has the orifice near the hinder part of the shield, and it contains a more distinctly formed shell. Such are the *Limax maximus* and *L. agrestis* of Linn.



Fig. 167.—*Limax rufus*.

\* Pulmonibranchiata of Blainville. [In consequence of some objections to the term *pulmonated* being applied to any invertebrate animals, urged by Lamarck, English authors often call this order the *Pneumobranchous*.—Ed.]

## THE VAGINULUS, Feruss.\*—

Has a close-fitted cloak without a shell, extended over the whole length of the body; four tentacula, of which the inferior are somewhat forked; the anus quite at the posterior extremity, between the end of the cloak and that of the foot; and the same orifice leads to the pulmonary cavity situated along the right flank. The orifice of the male organ of generation is under the right inferior tentaculum, and that of the female organ under the middle of the right side. These organs, as well as those of digestion, are very similar to those of the Snail. The genus belongs to both Indies, and is much like our Slugs.

## THE TESTACELLÆ, Lam.—

Have the respiratory aperture, and the anus, near the posterior extremity; their cloak is very small, and also placed there, and contains a small ear-shaped shell, which does not equal one-tenth of the length of the body. In other respects, these animals resemble our Slugs.

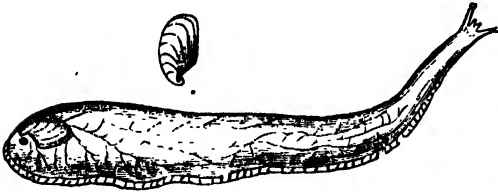


Fig. 158.—The Testacella.

One species is found abundantly in our southern departments (*Testacella hallotoidea*, Diaparn.), living under ground, and feeding principally on earth-worms. M. de Ferussac has observed that its cloak assumes an extraordinary development when the animal finds itself in too dry a situation, and thus produces for itself a sort of shade and shelter.

[There are some interesting illustrations of the habits of the Testacellæ in Loudon's *Magazine of Natural History*, vol. vii.]

## THE PARMACELLA, Cuv.—

Has a membranous cloak, with loose margins, situated [upon a gibbosity] in the middle of the back, and containing, in its posterior part, an oblong flat shell, which exhibits the mere vestige of a spine. The respiratory aperture, and the anus, are under the right side of the middle of the cloak.

The first known species was from Mesopotamia (*Par. Olivieri*, Cuv.); but we have now one from Brazil, and some others from India.

In the terrestrial Pulmonea with a perfect and exterior shell, the margin of its aperture is in general thickened and reverted in the adult.

Linnæus referred to his genus

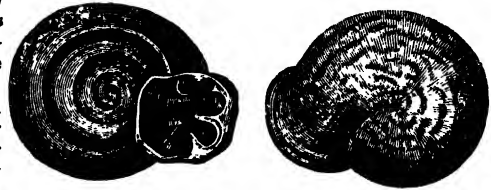
## HELIX,—

Every species in which the aperture of the shell (somewhat encroached upon by the projection of the penultimate whorl) assumes a crescent-like figure.

When this lunated aperture is wider than it is deep, the shells belong to *Helix*, Brug. & Lam. In some, the shell is globular. Everybody knows the edible Snail (*Hel. pomatia*, Linn.), common in gardens and vineyards, and esteemed as a delicacy in some departments; and the common Snail (*Hel. nemoralis*, Linn.), remarkable for the vividness and variety of its colours, and very hurtful to garden stuffs in wet seasons. There is no one who has not heard of the curious experiments, showing to what extent they can reproduce amputated parts.

Other species have a depressed shell, or one with a flattened spire; and we ought not to pass over without notice such as have interiorly projecting ribs, nor those in which the last whorl is abruptly turned up in the adult [so that the aperture appears in the same plane as the spire], and then assumes an irregular plicated form,—hence denominated *Anastoma*† by Lamarck.

The *Vitrina*, Drap. (*Helico-Limax*, Feruss.), are Helices with an extremely thin subspiral shell, without an umbilicus, and with an ample aperture, whose margin is sharp and even. The body of the Snail is too large to be drawn within the shell. The cloak has a double edge; and the superior fold, which is divided into several lobes, may be made to overlap the shell so as to clean and polish it. The European species live in moist situations, and are very small; but there are some of large size in warm climates.

Fig. 159.—*Anastoma globosa*

\* Synonymous with the *Onchidium* of Buchanan; and the *Feroniella* of Blainville is not different.—Ez.

† The peculiarity which distinguishes this genus from all the other Heliciform Univalves is so extraordinary, that it appears to us to be deserving of particular notice, inasmuch as it evidences a considerable alteration in the habit and economy of the animal which produces it, at the time of its arrival at its last period of growth, when it forms

the reflected outer lip, and the teeth in the aperture. Until then, the animal must crawl about like other Snails, with the spire of its shell uppermost; but as soon as it arrives at maturity, and is about to form its complete aperture, it takes a reverse position, and afterwards constantly carries its spire downwards.—SOWERBY. Two species are known.—Ez.

We ought to arrange near them some *Helices* which, without having a double-edged cloak, are equally incapable of retreating within their shell. *Helix rufa* and *brevipex*, Ferus., are examples.

When the depth of the aperture is greater than its width, as is always the case in shells with an oblong or elongated spire, they are the terrestrial *Bulimi* of Brug., which it appears necessary to subdivide as follows:—The *Bulimus*, Lam., have an oval rim, thickened in the adult, but without denticulations. In tropical countries, there are some large and beautiful species; some remarkable for the size of their eggs [equal to that of a Pigeon], and with an equally solid shell; and others for their reversed shells. In our own country there are several of small or moderate size, and one of them (*Helix decollata*, Gm.) has the singular habit of breaking off in succession the whorls from its spire. This example has been quoted as a proof that the muscles of the animal can be voluntarily detached from the shell; for a time does come when this *Bulimus* preserves no more than a single whorl of all those it possessed at the beginning of the decollation.

The *Pupa*, Lam., have an obtusely-pointed shell, whose last whorl is narrower than the penultimate, whence it has an elliptical, or sometimes a cylindrical form. The mouth is surrounded by a thickened rim, and encroached upon, on the side of the spire, by the penultimate whorl. The species are very small, living in moist stations, amongst mosses, &c. There is sometimes no toothlet in the aperture, but oftener there is one or more either on the projecting part of the penultimate whorl, or within the outer margin. [The genera *Vertigo*, Müll., and *Alcea*, Jeffreys, appear to have been separated from *Pupa* on too slight grounds; for the inferior tentacula are not absent, as is alleged, but only reduced to a minimum. The *Partula*, Fer., deserves probably to be kept distinct; for the species are ovo-viviparous, while all the others are oviparous.]

The *Chondrus*, Cuv., has, as in these latter *Pupa*, the mouth of the shell encroached upon by the penultimate whorl, and guarded with plates or toothlets; but the figure of the shell is more ovate, and more like that of the common *Bulimi*. Some have the teeth on the rim of the aperture, and others have plaits situated deeper within it. [This genus appears to be synonymous with the *Aseca* of Leach.]

Here terminates the section of terrestrial *Helices* whose shell has a thickened oral rim [or *peristome*] in the adult.

The *Succinea*, Drap., has an ovate shell, with an aperture longer than its width, as in *Bulimus*, but larger in proportion; the outer lip sharp, and the side of the columella almost concave. The Snail is too large to be contained in it, and we may almost regard it as a Testacella with a big shell. The inferior tentacula are very small. It lives upon the herbs and the shrubs of the brinks of rivulets, whence it has been considered as an amphibious genus.

We ought to separate from the genus *Turbo* of Linnæus, and approximate near the terrestrial *Helices*, the

#### CLAUSILIA, Drap.,—

Known by the slender, long, and pointed shell, with the last whorl narrower than the penultimate in the adult, compressed, and a little detached. Its mouth is entire and margined, and often toothed or

furnished with plates. There is mostly found, within the last whorl, a little lamina [commonly termed the *clausium*], slightly curved, a little like the letter S, the use of which to the animal is unknown to us.\* The species are small, and live in moss, at the foot of trees, &c. A great number of them are reversed.

#### THE ACHATINA, Lam.—

Ought likewise to be separated from the *Bulle* of Linnæus, and brought hither. The oval or oblong shell has the aperture of *Bulimus*, but is not margined; and has the extremity of the columella truncated, which is the first index of the emarginations we find in so many of the shells of the marine Gasteropodes. These *Achatina* are large Snails which feed on trees and shrubs in hot climates.† Of such as have, within the last whorl, a callus or particular thickening, Montfort makes his genus *Liguus*. The body-whorl is proportionally narrow; and when the end of the columella is curved towards the in-



Fig. 160.—*A. zebra*

Fig. 161.—*A. virginica*.

side of the aperture, and the body-whorl is broader, the species constitute Montfort's *Polyphemes*.

\* The use is to close the aperture of the shell when the Snail has retired. See a good description of its mechanism by Mr. J. E. Gray, in *Zool. Journ.* vol. i. p. 212.—Ed

† "The greater number of *Achatina*," says Sowerby, "are African

shells: some are West Indian, and a very few European. Among the latter, we can only lay claim to one as decidedly a native of this country, the *A. acicula* of Lamvreck."—Ed.

THE AQUATIC PULMONEA have only two tentacula. They come ever and anon to the surface to breathe, so that they can only inhabit waters of inconsiderable depth: thus they live in fresh waters or in brackish pools, or at least near the sides and mouths of rivers.

There are some amongst them without a shell: such is the

#### ONCHIDIUM, Cuv.\*

A large fleshy cloak, of the shape of a buckler, overlaps the foot on every side, and even covers the head when this is contracted. It has two long retractile tentacula, and over the mouth a veil, sinuated, or formed of two triangular compressed lobes. The anus and air-passage are under the hinder margin of the cloak, where, a little deeper, we find also the pulmonary sac. Near them, to the right, is the opening of the female organs, while, on the contrary, that of the male organ is under the right tentaculum; and these two orifices are united by a groove which runs under and along the right edge of the cloak. Destitute of jaws, they have a muscular gizzard, succeeded by two membranous stomachs. Several species inhabit the coasts of the sea, but always in such a situation that they are uncovered at ebb tide, when they obtain the air necessary to respiration.

The Aquatic Pulmonea, with perfect shells, have been placed by Linnæus in his genera *Helix*, *Bulla*, and *Voluta*, whence they ought to be withdrawn. In *Helix* were the two following genera, whose aperture, as in *Helix*, had its inner [or pillar] margin protuberant and arcuate:—

#### THE PLANORBIS, Brug.,—

Had already been distinguished from *Helix* by Bruguières, and even previously by Guettard, because the whorls of their shell, rolled up nearly on a level, enlarge insensibly, and the mouth is wider than deep.† It contains a Snail with long, slender, filiform tentacula, at the inner base of which the eyes are situated. It can exude, from the margin of its cloak, a copious red liquor, which is not to be mistaken for its blood. The stomach is muscular, and the food vegetable, as in the *Limnææ*, which are the faithful companions of the Planorbes in all our stagnant waters.

#### THE LIMNÆUS, Lam.,

Were separated from the *Bulimus* of Bruguières, because, notwithstanding the similarity of the shells, the margin of the *Limnææ* is sharp-edged and not reflected, and their columella has an oblique fold.

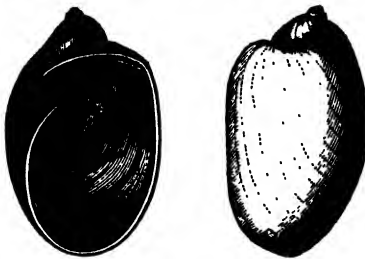


Fig. 162.—*Limnæa stagnalis*.

They abound in stagnant waters; and they are found plentifully, as well as the Planorbes, in marly or calcareous beds, which we thus discover to have been deposited from fresh water.

#### THE PHYÆ,—

Which were arranged arbitrarily among the *Bullæ*, have the shell of *Limnæus*, but still thinner, and there is no fold on the columella. The animal, when it swims or creeps, covers its shell with the two pectinated lobes of the cloak: it has two long setaceous tentacula, which are bulged at the base where the eyes are placed.

The species are small, and live in clear ponds. One of them (*Bulla fontinalis*, Lam.), has its whorls sinistral, [and this, indeed, is the only certain character which distinguishes the genus from *Limnæus*.]‡

\* M. de Blainville has changed the name *Onchidium* into *Peronia*, and transfers the first to the *Vaginulus*. He places *Peronia* amongst his *Cyclobranchia*; but I cannot perceive any real difference between their respiratory organ and that of the other Pulmonea. [As this genus is not the *Onchidium* of Buchanan, as Cuvier supposed, M. de Ferussac proposes to name it *Oncelis*.]

† Sowerby maintains that the shell in *Planorbis* is always reversed, or sinistral.—Ed.

‡ When the shell is oval-globose, and the cloak sufficiently ample to cover it, in an expanded state, the genus is the *Amphipylea* of Nilson; [and when the shell is turritid, and the cloak entire, the genus is named *Aplea* by Fleming.—Ed.]

From the observations of Van Hasselt it seems that we must here arrange

#### THE SCARABES, Montf.

The shell is oval, and the aperture contracted by large teeth projecting from both the columellar side as well as the outer lip: this lip is swollen, and as the animal re-makes it after every half-whorl, the shell is most protuberant on two opposite lines, and has a flattened aspect. The animals live on aquatic plants in the Indian Archipelago.

The two genera which follow were misarranged among the Volutes.

#### AURICULA, Lam.,—

Differing from all preceding aquatic Pulmonea by having their columella striated with large oblique channels. Their shell is oval or oblong; the aperture of the shape of the Bulimus or Limnæus; the lip furnished with a varix. Several species are of considerable bulk; but it is not ascertained if they live in marshes, like the Limnæus, or merely upon their margins, after the manner of the Succinea.

[One species, according to Lesson, lives in fresh water; the others appear to be terrestrial, living on rocks by the sea-side.] We find only one in France, from the coast of the Mediterranean (*Auricula myosotis*, Drap.) The male has two tentacula, and the eyes are at their bases. [*Carychium*, Muller, answers so nearly to the description of *Auricula*, that the genera ought probably to be conjoined. The typical species (*C. minimum*) lives under leaves in shaded woods.]

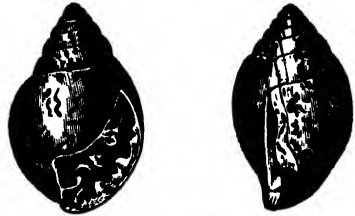


Fig. 163.—*Auricula scarabæus*.

#### THE MELAMPES, Montf. (*Conovulus*, Lam.),

Like the *Auricula*, have prominent plaits on the columella, but their aperture has no varix, and its inner lip is finely striated: the shell has somewhat the shape of a cone, of which the spire makes the base. They inhabit the rivers of the Antilles.

### THE SECOND ORDER OF THE GASTEROPODES.

#### THE NUDIBRANCHIATA.\*

They have neither a shell nor pulmonary cavity, but their branchiæ are exposed naked upon some part of the back: they are all hermaphroditical and marine: they often swim in a reversed position, the foot applied against the surface, and made concave like a boat; and they assist their progress by using the edges of the cloak and the tentacula as oars.

#### THE DORIS, Cuv.,—

Have the anus in the posterior part of the back, and the branchiæ are arranged in a circle round the

anus; and as each resembles a little arbuscule, they constitute altogether a sort of flower. The mouth is a small proboscis, situated under the anterior edge of the cloak, and is furnished with two small conical tentacula. There are other two tentacula, of a conoid figure, [and lamellated structure,] which issue from the superior and anterior part of the cloak. The organs of generation have their orifices



Fig. 164.—*Doris cornuta*.

near to each other, under its right margin. The stomach is membranous. A gland, intimately interlaced with the liver, sheds a peculiar secretion, that escapes outwards by a hole near the anus. The species are numerous, and some of them of considerable size. We find them on the shores of every sea.† Their spawn is shed in the form of a gelatinous ribbon, on rocks and sea-weeds, &c.

The *Onchidores*, Blainv., only differ from the *Doris* in the wider separation of their sexual organs, whose orifices communicate by a furrow drawn along the right side, as in the *Onchidia*. The *Plocamoceres*, Leuckard, have all the characters of *Onchidores*, and moreover the anterior edge of their cloak is adorned with numerous branched tentacula. The branchiæ of *Polycera*, Cuv., are like those of *Doris*, but simpler, and furnished with two mem-

\* My first four orders are joined together by M. de Blainville into what he calls a sub-class, and names *Paracephalophora monica*. Of my Nudibranchiata he makes two orders: in the first (*Cyclobranchiata*) he places the *Dorides*; in the second (*Polybranchiata*) the *Tritonia* and its allies, which he divides into two families, according

as they have two or four tentacula.

† The Scottish species are described by Dr. Johnston in the 1st vol. of the *Annals of Natural History*; and Montagu has described many British species in the *Linnaean Transactions*.—Ed.

branous laminae to cover them in time of danger : and besides the two conoid tentacula in front, similar to those of *Doris*, they have four, or sometimes six others, which are simply pointed.

#### THE TRITONIES (*Tritonia*, Cuv.).—

Have a body, superior tentacula, and generative organs, as in the *Doris* ; but the anus and the vent of the peculiar secretion are on the right side, behind the vulva : the arbuscular branchiæ are arranged along each side of the back, and the mouth, guarded by broad membranous lips, is armed within with two lateral horny and cutting jaws, in shape somewhat like to the scissors for shearing sheep.

We have a large species (*Tritonia Hombergii*, Cuv.) on our coasts ; and there are many others, some of them very small, which exhibit great variety in the size and figure of their branchiæ. [*Melibe*, Rang, differs in having filiform simple tentacula issuing from a wide sheath, and two series of ovate muricated or tuberculated branchiæ on the back, which readily fall off when the animal is handled. *M. rosea*, which lives on floating sea-weeds near the Cape of Good Hope, is the type ; but there are some European Mollusca, of small size, which are also referable to it.]



Fig. 165.—*Tritonia*.

#### THE THETHYS, Linn.—

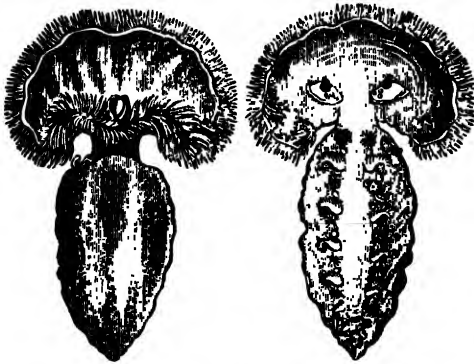


Fig. 166.—*Thethys leporina*, upper and under sides.

Have along the back two rows of tufted branchiæ ; and upon the head a very large membranous fringed veil which curves, in its contraction, under the mouth. The mouth is a membranous proboscis without jaws : there is at the base of the veil two compressed tentacula, from the margin of which issues a small conical point. The orifices of generation, of the intestine, and of the peculiar secretion, are as in *Tritonia*. The stomach is membranous, and the intestine very short.

There is, in the Mediterranean, a beautiful species of a greyish colour, spotted with white (*Thetis Ambria*, Linn.).

#### THE SCYLLÆ, Linn.

In this genus the body is compressed ; the

foot narrow and furrowed, to enable it to embrace the stems of sea-weed ; no veil ; the mouth forming a small proboscis ; the exterior orifices as in *Thethys* ; the tentacula compressed, terminating in a cavity from which a little point, with an unequal surface, can be protruded ; and upon the back are two pairs of membranous crests, carrying, on their inner aspect, some pencils of branched filaments. The middle of the stomach is covered with a fleshy ring, armed with horny laminae as sharp as a knife. The common species is found on *Fucus natans*, or gulf-weed, wherever this appears.



Fig. 167.—*Scyllæa pelagica*

#### THE GLAUCUS, Forster,

Have the elongate body and the vents as in the preceding ; four minute conical tentacula ; and on each side [two or] three branchiæ, each formed of long fringes arranged like a fan, and by whose means they swim. They are little charming Molluscs of the Mediterranean and Indian Ocean, agreeably painted with azure-blue and silver, and swim with great quickness on their backs. Their anatomy closely resembles that of *Tritonia*. The species have not, as yet, been satisfactorily distinguished.



Fig. 169.—*Glaucus Forsteri*.

The *Lanigærus*, Blainv., has, on each side, two series of little plates, finely divided in a pectinate manner, which are the branchiæ. The body is shorter and thicker than in *Glaucus*, but they have its four little tentacula.

#### THE EOLIDIA, Cuv.,

Resemble little slugs, with four tentacula above, and two on

the sides of the mouth. Their branchiæ are tentaculiform processes or papillæ disposed along the sides, overlying like scales, [or held erect]. They inhabit all seas.

The *Cavolina*, Bruguière, have the habit of Eolidia, but their branchiæ are disposed in rows across the back.

The *Flabellines*, Cuv., still exhibit the tentacula of the preceding genera, with branchiæ composed of radiating filaments supported on five or six pedicles on each side. They approximate the Glaucus; and in general it is to be remarked, that all the Nudibranchiata with branchiæ placed upon the sides of the back are nearly affined.

#### THE TERGIPES, CUV.,

Are in shape like the Eolidia, but have only two tentacula, and along each side of the back there is a row of cylindrical branchiæ, each terminated by a little sucker, which enables them to be used as feet: hence the creature can walk in a reversed posture. [This singular structure of the branchiæ, and their pedestrian use, requires to be confirmed.] The known species are very small.

The *Busiris*, Risso, is known by its oblong body, convex back, two filiform tentacula, and behind them, upon the neck, two plumose branchiæ.

The *Plocobranchus*, Van Hasselt, has two tentacula, and two labial lobes, and the whole back, widened at the sides, covered with numerous radiating striæ, which are the branchiæ. In their natural conditions, the widened margins of the cloak are raised, and overlap each other so as to form a covering to the branchiæ, which are thus placed in a sort of cylindrical sheath. The only species yet known is from the shores of Java.

### THE THIRD ORDER OF THE GASTEROPODES.

#### THE INFEROBRANCHIATA.

These have nearly the habit and organization of *Doris* and *Tritonia*, but their branchiæ, instead of being situated upon the back, are on the sides of the body, under the projecting margin of the cloak, where they form two long series of leaflets. [The species are strictly littoral, being gasteropodous and incapable of swimming.]

#### THE PHYLLIDIA, CUV.

Their naked, and generally coriaceous cloak, is not protected by any shell. Their mouth is a small proboscis, and has a tentaculum at each side; two other tentacula protrude above from two little cavities of the cloak. The anus is in the hinder part of the cloak, and the orifices of generation under the right side in front. The heart is about the centre of the back; the stomach is simple, membranous; and the intestine short. There are several species in the Indian ocean.

#### THE DIPHYLLIDES, CUV.—

Have branchiæ nearly similar to those of Phyllidia, but the cloak is more pointed behind; the head, of a semicircular figure, has a pointed tentaculum on each side, and a slight tubercle: the anus is on the right side.

[The *Ancylus*, Geoffroy,—a fresh-water Gasteropode, with a shell similar to that of a *Patella*, is placed by Rang in this order. He asserts that the animal is branchiferous, while the Rev. Mr. Berkeley has asserted that it is pulmonated. They live in stagnant waters and in rivulets, adhering to stones and aquatic plants.]

### THE FOURTH ORDER OF THE GASTEROPODES.

#### THE TECTIBRANCHIATA.\*

They have their branchiæ attached along the right side, or upon the back, in the form of more or less divided, but not symmetrical, leaflets; these are more or less covered by the mantle, in which a small shell is generally contained. They approximate the Pectinibranchiata

\* The *Monopleurebranchiata* of Blainville.



in the form of the respiratory organs, and, like them, live in the sea ; but they are hermaphrodites, like the Nudibranchiata and Pulmonea.

#### THE PLEUROBRANCHUS, Cuv.\*

The cloak and the foot both jut beyond the body, which thus appears as if it were between two bucklers. The former contains, in some species, a little oval calcareous plate ; in others, a horny one, and in either case it is situated above the head. The branchiæ are placed along the right side, in a groove between the cloak and foot, and represent a series of pyramids divided into triangular leaflets. The mouth, in the form of a small proboscis, is overhung with an emarginate lip, and with two tubular cleft tentacula ; the orifices of generation are before, and the anus behind the branchiæ. There are four stomachs, of which the second is fleshy, sometimes armed with osseous pieces, and the third is garnished with prominent longitudinal laminae. The intestine is short.

There are different species in the Mediterranean and Indian Ocean, some of which are large and beautiful. [We have two British species.]

#### THE PLEUROBRANCHÆA, Meckel (*Pleurobranchidium*, Blainv.),—

Has the branchiæ and the orifices of generation situated as in *Pleurobranchus* ; but the anus is above the branchiæ ; the margins of the cloak and of the foot project but a little, and upon the front of the cloak are four short distant tentacula, forming a square which forces a comparison with the anterior disk of the *Aceres*. I find but one stomach, with thin parietes, which is a mere dilatation of the intestine. A greatly divided glandular organ opens outwardly behind the genital orifices. There is no trace of a shell.

The only known species is from the Mediterranean.

#### THE APLYSIA, Lin. ☉

The margins of the foot are turned up into flexile crests, and, surrounding the back on every side, they can be reflected over it. The head, supported on a neck of greater or less length, has the two superior tentacula hollowed like the ears of a quadruped, and two others of a flattened shape at the end of the inferior lip ; the eyes at the base of the former. Upon the back we find the branchiæ in the form of complicated leaflets, attached to a broad membranous pedicle, and concealed by a little cloak, equally membranous, which contains a horny flat shell. The anus is behind the branchiæ, and is often concealed under the lateral crests : the vulva is to the right in front, and the penis issues from under the right tentaculum. A groove, which extends from the vulva to the very extremity of the penis, conducts the semen thither in copulation. A membranous crop, of enormous size, leads into a muscular gizzard, armed inside with many cartilaginous and pyramidal bodies ; and this is followed by a third stomach beset with sharp hooks, and a fourth in the form of a cæcum. The intestine is voluminous. These animals feed on sea-weed. A peculiar gland pours out, through an orifice near the vulva, a limpid humour, which is said to be very acrid in some species ; and from the edges of the cloak there oozes in abundance a deep purple liquid, with which the animal discolours the water of the sea when it perceives danger to be at hand. Their ova are laid in long glairy entangled filaments, as slender as threads.

There are found in our seas *Apl. fasciata*, Poiret, *punctata*, Cuv., and *depilans*, Linn. ; and the shores of foreign countries possess several others.

#### THE DOLABELLA, Lam.—

Differs only from *Aplysia* in the position of the branchiæ at the posterior extremity of the body, which resembles a truncated cone. The lateral crest fits close to the branchial apparatus, leaving merely a narrow groove. The shell is calcareous.

The species are found in the Mediterranean and in the Indian Ocean.

#### THE NOTARCHUS, Cuv.— †

Has the lateral crests united and covering the back, leaving merely a longitudinal fissure to conduct water to the branchiæ. These have no cloak to cover them, but in other respects they resemble the branchiæ of the *Aplysia* ; and the organization of the two genera is otherwise similar. In

\* The name as the *Lamellaria* of Montagu, [a name which the Botanists have usurped,] and the *Berthella* of Blainville. [This genus, *Pleurobranchia*, *Umbrella*, *Spiricella*, and *Siphonula*, are placed in the preceding order by Rang.]

THE BURSATELLES, Blainv.—

The lateral crests are united in front, so as only to leave an oval opening for the water to pass to the branchiæ which are also destitute of a covering cloak. It is, however, probable that this genus should be allowed to lapse into the *Notarchus*.\*

THE ACERES, (*Akera*, Muller)—

Have the branchiæ covered like the preceding genera, but their tentacula are so much shortened, widened, and separated, that there seems to be none at all, or rather they form together a large, fleshy, and nearly square buckler, under which the eyes are placed. Moreover, their hermaphroditism, the position of their sexual organs, the complexity and structure of the stomach, the purple liquid which several of them shed, all approximate them to the *Aplysiæ*. The shell, in such as have one, is more or less convolute, with a slight obliquity, without a visible spire, and the mouth has neither sinus nor canal; but as the columella is convex and protuberant, the mouth has a

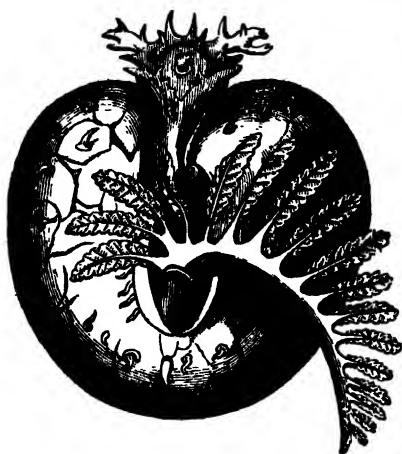


Fig. 169.—*Bursatella Lenchii*.

crescent-like shape, and the part opposite to the spire is always widest and rounded. When the shell is buried in the cloak, M. de Lamarck names the genus *Bulla*. The shell has few whorls, and is too small to contain the animal.

The *Bulla aperta*, Lam., is an example which is found in almost every sea, where it lives on oozy bottoms. When the shell is [external], covered with a thin epidermis and sufficiently roomy, M. de Lamarck allows them to retain the old name *Bulla*. The *Bulla lignaria*, *ampulla*, and *hydatis* are examples, [distinguished not only by the characters of the shells, but by peculiarities in the armature of the stomach, which consists of two or three comparatively large osseous pieces or jaws of different shapes in each. Of those of *B. lignaria*, Gioeni constituted a genus to which he assigned



Fig. 170.—*Bulla aperta*.

his own name; it is the *Tricla* of Retzius, the *Char* of Bruguière, and disfigured our systems until the cheat was detected by Draparnaud.] I restrict the term *Acera* to such species as have no shell whatever, or merely a vestige of it behind, although the cloak has the external form of one. The genus is the *Doridium* of Meckel and *Lobaria*, Blainv. There is a small species in the Mediterranean (*Bulla carnosa*, Cuv.), whose stomach



Fig. 171.—*Bulla lignaria*.



Fig. 172.—*B. ampulla*.

is as destitute of any armature as its cloak is of a shell, but the œsophagus is fleshy and very thick.

THE GASTROPTERON, Meckel,—

Appears to be only an *Acera* with the sides of the foot expanded into broad fins, by whose aid it is enabled to swim, which it does in a reversed position. It also has no shell, and no stony apparatus in the stomach. A very slight fold of the skin is the sole vestige of a branchial cover to be observed.

The one species known (*G. Meckelii*) is a Mediterranean Mollusk, about an inch long by two in breadth, when its wings are spread out.

Until a more ample anatomy has been made of it, we believe that it is in this order, and near to the *Pleurobranchus*, that the singular genus

UMBRELLA, Lam. (*Gastroplax*, Blainv.)—

Should be placed. The animal is a great circular Mollusk, whose foot exceeds by much the cloak, and has its upper surface roughened with tubercles. The viscera are in a superior and central rounded part. The cloak is only visible by its slightly projecting sharp edge along the entire front, and on the right side. Under this slight edging of the cloak are the branchiæ, in lamellated pyramids, like those of *Pleurobranchus*; and behind them is a tubular anus. Under this same margin, in front, are two

\* *Aplysia viridis*, Montg., raised to a genus by Oken under the name of *Actæon*, and which is at least nearly allied to the *Elysia claudia* of Risso, has been considered as a near ally of *Aplysia*, but from a knowledge of the branchiæ, I cannot classify it. [The branchiæ

cover the back and the superior surface of the lobes under the form of a vascular network, so that the true position of the *Elysia* is next to *Placobranchus*.]

tentacula, longitudinally cleft as in Pleurobranchus, and at their inner bases are the eyes: between them is a kind of proboscis, perhaps an organ of generation. There is a large concave space in the anterior margin of the foot, the edges of which can be drawn together like the mouth of a purse; and at its bottom is a tubercle pierced with an orifice, which is perhaps the mouth, and is surmounted by a fringed membrane. The inferior surface of the foot is smooth, and serves the animal to crawl on, as in other Gasteropodes. It carries with it a hard, flat, irregularly-rounded shell, thickest in the centre, with sharp margins, and lightly marked with concentric striæ. It was supposed at first that the shell was attached to the foot, but more recent observations have proved that it is upon the cloak, and in its usual place.

[Two species have been discovered: one in the Indian Ocean, the other in the Mediterranean.]

## THE FIFTH ORDER OF THE GASTEROPODES.

### THE HETEROPODA, Lam.\*

The Heteropoda are distinguished from all other Mollusca by their foot, which, instead of forming a horizontal disk, is compressed into a vertical muscular lamina, which they use as a fin; and on the edge of which, in several species, is a sucker in the form of a hollow cone, that represents the disk of the other orders. Their branchiæ, formed of plumose lobes, are situated on the hinder part of the back, and point forwards; and immediately behind them are the heart and liver, of inconsiderable size, with a portion of the viscera and the interior organs of generation. The body, of a transparent gelatinous substance, sheathed with a muscular layer, is elongate, and generally terminated with a compressed tail; the mouth has a muscular mass and a tongue garnished with little hooks; the gullet is very long; the stomach thin; two prominent tubes, on the right side of the bundle of the viscera, serve as passages to the excrements, and to the eggs or semen. They swim, in ordinary, in a reversed position; and they can inflate the body with water in a manner which is not yet well understood.

Forskål comprised them all under his genus *Pterotrachea*, which it is necessary to subdivide.

### THE CARINARIA, Lam.—

Has the nucleus (formed by the heart, the liver, and organs of generation,) covered with a thin, sym-



Fig. 173.—Carinaria; the shell of its natural size, and a reduced figure of the animal, with the position of the shell on it.

metrical, conoid shell, with the point curved backwards, and often raised into a crest; under its anterior margin, the plumes of the branchiæ float; on the head are two tentacula, and the eyes are behind their roots.†

One species (*Car. cymbium*, Lam.) inhabits the Mediterranean; another the Indian Ocean (*Car. fragile*, B. St. Vincent). The *Argonauta vitrea* of authors may be a Carinaria, but its animal is unknown.

### THE ATLANTA, Lesueur, —

From the observations of M. Rang, should be animals of this order, whose shell, in place of being expanded, has a narrow cavity, and a spire rolled up on the same plane: its contour is raised into a thin crest. They are very

small shells of the Indian Sea; and in one of them, Lamanon believed that he had found the original of the Ammonites.

\* M. de Blainville makes a family of this order, which he names *Nectopoda*, and unites them in his *Nucleobranchiata* with another family named the *Pteropoda*, comprising, however, only *Limacina* of my Pteropodes. He adds to it, upon I know not what conjecture, the

*Argonauta*. [Sowerby has also contended for *Argonauta* being arranged near to *Carinaria*.]

† See a description of the animal by M. Verony in the *Zool. Journ.* vol. v. p. 236.—Ed.

THE FIROLA, Peron,—

Has the body, the tail, the foot, the branchiæ, and the nucleus of the viscera, nearly the same as the Carinaria, but no shell has been observed. Their snout is prolonged into a recurved proboscis, and their eyes are not fronted with tentacula. There is often seen hanging at the end of their tail, a long jointed thread, which Forskal considered to be a Tape-worm, and the nature of which is not yet certainly determined.

One species (*Pterotrachea coronata*, Forsk.) is very common in the Mediterranean; and M. Lesueur has described several others from the same sea as different, but they require new and comparative examinations. Such as have the body abruptly truncate behind the visceral nucleus, instead of being terminated with a tail, M. Lesueur distinguishes as *Firoloides*.

To these genera, now well known, I suppose we shall, on a better acquaintance with them, have to add the *Timoriennes*, Quoy & Gaym., which appear to be Firolæ deprived of their foot and nucleus of viscera; and the *Monophores* of the same naturalists, which have nearly the form of Carinaria, but are also footless and shellless, nor have any visceral nucleus.

It is not so certain that we should place here the *Phylliroes* of Peron. The body, transparent and much compressed, has in front a snout surmounted with two long tentacula without eyes; behind, a truncate tail; and we can see through the integuments its heart, its nervous system, its stomach, and the genital organs of both sexes. The anus, and the orifices of the genital organs, are also on the right side, and a penis of considerable length is sometimes even protruded; but I cannot perceive any other respiratory organ than its thin and vascular skin.

## THE SIXTH ORDER OF THE GASTEROPODES.

### THE PECTINIBRANCHIATA.\*

This order is, beyond comparison, the most numerous of the class, since it comprehends almost all the univalve spiral shells, and several which are simply conical. The branchiæ, composed of numerous leaflets or fringes, ranged parallelly like the teeth of a comb, are affixed in one, two, or three lines (according to the genera) to the floor of the pulmonary cavity, which occupies the last whorl of the shell, and which communicates outwards by a wide gape between the margin of the cloak and the body. Two genera only—*Cyclostoma* and *Helicina*—have, instead of branchiæ, a vascular network clothing the ceiling of a cavity in all respects the same as that of the order; and they are the only ones which respire the atmosphere, water being the medium of respiration to all the rest.

All the Pectinibranchiata have two tentacula and two eyes, raised sometimes on pedicles; a mouth in the form of a proboscis, more or less lengthened; and separate sexes. The penis of the male, attached to the right side of the neck, cannot, in general, be drawn within the body, but is reflected into the branchial cavity; it is sometimes very large. The Paludina alone has the organ concealed, and it comes out through a hole pierced in the right tentaculum. The rectum and the oviduct of the female also creep along the right side of the branchial cavity; and there is between them and the branchiæ a peculiar organ, composed of cells filled with a very viscous fluid, the use of which is to form a common envelope for the inclosure of the eggs, and which the animal deposits with them. The form of that envelope is often very complicated and very remarkable.

The tongue is armed with little hooks [or curved spinules], and wears down the hardest bodies by slow and oft-repeated frictions.

The grand difference between these animals lies in the presence or absence of the canal formed by the prolongation of the margin of the branchial cavity on the left side, and which

\* In M. de Blainville's system, it forms the subclass *Paraccephalophora dioica*.

passes along a similar canal or sinus in the shell, to enable the animal to breathe without leaving its shelter. There is also this distinction between the genera—that some want the operculum; and the species vary in the filaments, fringes, and other ornaments that deck the head, the foot, or cloak.

We arrange these Mollusca under several families from the form of their shells, which appears to be in sufficiently constant harmony with that of their respective animals.

## THE FIRST FAMILY OF THE PECTINIBRANCHIATA,—

### THE TROCHOIDES,—

Is recognized by their shell having an entire aperture, without sinus or canal for a siphon, which the animals have not\*; and in being furnished with an operculum, or some organ as its substitute.

#### THE TROCHUSIDÆ (*Trochus*, Linn.).†

The mouth of the shell, angular at its exterior margin, approaches more or less to a quadrangular figure, and is in an oblique plane in relation to the axis of the shell, because that part of the margin next the spire advances more than the rest. The greater number of the animals have three filaments on each side of the cloak, or at least some appendages to the sides of the foot.

Among those which have no umbilicus, there are some in which the columella, in form of a concave arch, is continuous, without any projections, with the exterior margin. It is the angle and advance of this margin that distinguishes them from Turbo. These are the *Tectaria*, Montf. Several are flattened, with a sharp [spiny] margin, whence they have been compared to the rowel of a spur; these are the *Calcar*, Montf. Some again are a little depressed, orbicular, glossy, with a semicircular aperture and a convex callous columella; Lamarck calls such *Rotella*. Others have the columella marked near the base with a little prominence or vestige of a tooth, similar to that of Monodonta, from which these Trochusides differ only in the general shape of the aperture, which is, in the present instances, a little deeper than wide—they are the *Cantharides*, Montf. The aperture in others is, on the contrary, much wider than deep, and their concave base gives them a resemblance to the Calyptræ; these Montfort names *Entonnoirs*. Others, in which the aperture has the same great proportional width, have the columella in the form of a spiral canal. And those which have the shell turreted (*Telescopium*, Montf.) resemble the Cerithia.

Among the umbilicated Trochusidæ, some have no longer any projection on the columella; the greater number are flattened, and have the exterior angle sharp. Of this kind is *Trochus agglutinans*, Linn., remarkable for its habit of gluing and incorporating with its shell, in proportion as it grows, different foreign bodies, such as gravel, fragments of other shells, &c. It often covers its umbilicus with a testaceous plate. There are some also with rounded margins, of which we have a common example on our coasts, (*Tr. cinerarius*, Linn.). Other umbilicated Trochi have a prominence near the base of the columella: and lastly, in others it is crenulated throughout its length.

The *Solarium*, Lam., is distinguished from the other Trochi by its obtusely conical spire, whose broad base is perforated with a wide and deep umbilicus, in which the eye can trace the margins of all the whorls winding up [like an elegant miniature staircase], and prettily crenulated. The *Euomphalus*, Sowerby, are fossil shells similar to Solarium, but without crenulations on the inner whorls of the umbilicus.

#### THE PERIWINKLES (*Turbo*, Linn.).—

Comprise all the species with the shell perfectly and regularly turbinate, and of which the aperture is quite round. From a detailed examination of them, they have been greatly subdivided into genera. The *Turbo*, Lam., properly so called, have a round or oval thick shell, with an aperture completed on the side of the spire by the penultimate whorl. The animal has two long tentacula; the eyes raised on [short] pedicles at the exterior base; and, upon the sides of the foot, membranous expansions, either simple or fringed, or furnished with one or two filaments. To some of them those stony thick opercula belong which may be frequently observed in collections, and which were formerly used in medicine under the name of *Unguis odoratus*. Some are umbilicated (*Meleagris*, Montf.), and some are not so (*Turbo*, Montf.).

The *Delphinula* is a shell as thick [and solid] as the Turbo, but subdiscoid, and its aperture is entirely formed by the last whorl, and without a varix. The animal resembles the Turbo. The common species (*Turbo delphinus*, Linn.) takes its name from the branched curved spines that arm the whorls, and which have given rise to a comparison of it to a dried fish.

The *Pleurotoma*, DeFrance, are fossil shells with a round mouth, and a narrow deep incision on the outer margin. It is probable that this incision corresponds, as in Siliquaria, with some fissure of the cloak. M. Deshayes reckons already more than twenty-five fossil species. The *Scissurella* of M. d'Orbigny are recent species.

The *Turritella*, Lam., have the aperture of Turbo, but the shell is thin and elevated into an obelisk, or turreted.

\* Hence Blainville denominates the order *Asphenobranchiata*.

† Family *Gonistomata* of De Blainville.

The eyes of the snail are on the exterior base of the tentacula; the foot is small. There is a great number of fossil species; and we ought to unite with it the *Proto*, Deffr.

The *Scalaria* has the turreted spire of *Turritella*, with the aperture of *Delphinula*, but the spire is covered with longitudinal, elevated, rather acute ribs, and the mouth is encircled with a varix. The tentacula and penis of the animal are long and slender. The principal species, the *Turbo scalaris*, Linn., or the *Wendletrap*, has long been famous for the high prices given for a specimen. It is distinguished by its whorls being separate from each other. A small species without this peculiarity (*Turbo elatrus*, Linn.), is common in the Mediterranean.

We may arrange here some terrestrial or lacustrine subgenera, whose shells have an entire roundish operculated aperture. Of this number are the *Cyclostoma*, Lam., distinguished from all others by being terrestrious; and in place of branchiæ, there is a vascular network on the parietes of the pulmonic sac.\* In all other respects, *Cyclostoma* resembles the animals of this family. The spiral shell is finely striated in the direction of its rounded whorls, and, in the adult, the aperture is encircled with a small raised rim, and closed with a round thin operculum. The *Turbo elegans*, Linn., found in woods, under stones and moss, is the type of the genus.

The *Valvata*, Mull., live in fresh water. Their shell is obtusely conical, with a round operculated mouth; and the snail, which has two slender tentacula, and eyes at their inner base, breathes by means of branchiæ. In our native *V. cristata*, Mull., the branchia, in the shape of a miniature feather, protrudes from under the cloak, and floats in the water with a vibratory motion, when the animal wishes to breathe.† On the right side there is a filament that resembles a third tentaculum. The foot is two-lobed in front. The penis of the male is slender, and lies in the respiratory cavity. The shell, scarcely three lines in height, is corneous, obtuse, and umbilicated.

It is necessary to classify here some purely aquatic snails, which formerly made a part of the genus *Helix*, since the shell had the crescent-like aperture that constituted the character of that genus.‡ The three first genera are nearly allied to *Turbo*. Thus

#### THE PALUDINA, Lam.—

Have been separated from *Cyclostoma* because they have no rim or varix round the aperture; because this, as well as the operculum, has a little angle above; and because the animal, having branchiæ, must live in water. It has a very short proboscis, two setaceous tentacula, eyes seated on the external bases, a small membranous fin on each side of the body in front, the anterior margin of the foot lobed, the fin of the right side folded into a small canal to introduce the water into the respiratory cavity, an approach to the siphon of the following family. In the common species (*Helix vivipara*, Linn.), the female is viviparous, and we find the young, in spring, in the oviduct, in all stages of development. Spallanzani assures us that the young, kept separate from the moment of their birth, can give birth to others without having copulated, as happens with the Aphides. The males are, notwithstanding, as common as the females, their organ issuing from a hole in the right tentaculum, which is thus made larger than the other, and affords a character to know the sexes by.

In the sea there are some shells that differ from *Paludina* only in their superior thickness. These are

#### THE LITTORINA, Feruss.

The common species, or Periwinkle, swarms on our coasts, and is eaten. [The *Lacuna* of Turton is a *Littorina* with a perforation in the pillar.] The *Monodon*, Lam., differs from *Littorina*§ in having a blunt tooth at the base of the columella, which has in some also a fine incisure. Several are crenulated on the outer lip. The animal is more ornamented, carrying in general on each side three or four filaments as long as the tentacula. The eyes are elevated on pedicles on the outer side of the root of the tentacula. The operculum is round and horny.

*Trochus tessellatus*, Linn., is an abundant example on the French coast.

#### THE PHASIANELLA, Lam.—

Have a shell similar in shape to that of *Limneus* and *Bulimus*, but the aperture is closed with a calcareous operculum, and the base of the columella is sensibly flattened and without an umbilicus. The shells are much sought after by amateurs, from the beautiful speckled manner in which their various colours are disposed. Their snail has two long tentacula, with the eyes on tubercles at their exterior bases, double lips emarginated and fringed, as well as the lateral fins carrying each three filaments.

[*Planaxis*, Lam., is nearly allied to *Phasianella*, from which, however, it may be distinguished by the truncation of the anterior part of the pillar. There are six species known, one of which is so common on the shores of the Isle of France that the rocks, in some places, are covered with it.]

\* For this reason M. de Ferussac, with *Cyclostoma* and *Helicina*, makes a distinct order—his *Pulmones operculati*, [which has been adopted by Rang and many other systematists; and seems warranted by the anatomy of the former genus given by the Rev. Mr. Berkeley in the *Zool. Jour.* iv. p. 283.]

† Hence Dr. Fleming was induced to institute the order *Cervicibranchia* for the genus, which he afterwards arranged with the *Nudibranchia*.—Ed.

‡ They constitute the family *Elipsostoma* of De Blainville.

§ Sowerby more properly unites *Monodon* with *Turbo*.—Ed.

## THE AMPULLARIA, Lam.—

Has a roundish ventricose shell with a short spire, like most of the Helices; its aperture is higher than wide, furnished with a [calcareous] operculum, and the columella umbilicated. They live in the fresh and brackish water of hot climates. The animal has long tentacula, and pedunculated eyes. At the bottom of the respiratory sac, by the side of the long branchial comb, there is, according



*Nerita*, Lam. (*Peloronta*, Oken), has no umbilicus. Their shell is thick, the columella toothed, the operculum calcareous. The eyes of the animal are supported on pedicles at the sides of the tentacula; and the foot is moderate in size. There is but slight reason to distinguish among them the *Velates*, Montf., where the side of the columella is covered with a thick, swollen, calcareous layer; and the *Neritina*, Lam., in which the columella is toothless, and the animals are inhabitants of fresh waters. Some have, however, a delicately toothed columella, and among these is one whose spire is armed with long spines, (*Githo*, Montf.). [The species of *Nerita* are very numerous. M. Leason has brought one from Australia, where it lives abundantly upon trees! This fact ought to make us more than ever wary of separating the marine from the fluviatile species. Indeed, some real *Neritina* can live both in fresh and salt water, and others are altogether marine.]

Recent observations induce us to arrange near to the Trochoidea

## THE SECOND FAMILY OF THE PECTINIBRANCHIATA,—

### THE CAPULOIDES,\*—

Which comprises five genera, four of which are dismembered from *Patella*. All of them have a widely open shell, scarcely turbinate, without an operculum, or emargination or canal. The animal is male and female, and resembles the other Pectinibranchiata. Their branchial comb is single, laid across the vault of the cavity, and its filaments are often very long.

#### CAPULUS, Mont. (*Pileopsis*, Lam.)—

Have a conical shell, with the summit recurved a little in spiral, whence they were for long placed with the *Patellæ*. The branchiæ are in a series under the anterior margin of their cavity; the proboscis is of considerable length; under the neck is a much plaited membranous veil; there are two conical tentacula with the eyes at their base on the outside.

*Hipponyx*, DeFr., appear from their shell to be fossil Capuli, but are very remarkable for the base of calcareous layers on which they rest, and which has probably been excreted by the foot of the animal. [*Hipponyx* is a truly bivalve shell.]

#### CREPIDULA, Lam.

Shell oval [variable], with an obtuse point obliquely inclined backwards towards the margin: the under-side is generally concave, and the inner lip forms a broad, flattish, sharp-edged, toothless, horizontal plate, which about half covers the aperture. The abdominal sac containing the viscera is upon this plate, the foot under it, the head and the branchiæ in front. The branchiæ consist of a series of long filaments attached under the anterior margin of the branchial cavity. Two conical tentacula bear the eyes at their exterior bases.

*Pileolus*, Sowerby, seem to be *Crepidula*, of which the transverse plate occupies half of the aperture, but their shell has a greater resemblance to *Patella*. The few species known are fossil.

*Septaria*, Férus. (*Navicella*, Lam.), resemble the *Crepidula*, excepting that their summit is symmetrical, and turned down on the posterior margin, and their horizontal plate projects less. The animal has, moreover, a testaceous plate of an irregular shape, attached horizontally upon the superior surface of the muscular disk of the foot, and covered by the abdominal sac, which rests in part above. It is, probably, the analogue of an operculum but does not fulfil its office, being in some degree internal. The animal has long tentacula, and at their outside are peduncles to support the eyes. They live in the rivers of warm countries.

#### CALYPTRÆA, Lam.

Shell conoid, the cavity furnished with a lateral internal appendage, very variable in form, which is as it were the beginning of a columella, and is interposed in a fold of the abdominal sac. The branchiæ are composed of a range of numerous hair-like filaments. Some have the appendage adhering to the bottom of the cone, folded itself into a cone, or tube, and descending vertically. Others have it placed almost horizontally, adhering to the sides of the cone, which is marked above with a spiral line, that gives to their shell some relation to that of the *Trochus*.†

#### SIPHONARIA‡, Sowerby.

Dismembered from *Patella*, to which in general form and appearance it very nearly approaches, but its margin is a little more prominent on the right side, and it is hollowed underneath with a shallow groove which opens at this prominence, and with which a lateral hole in the cloak corresponds, to intro-

\* M. de B'airville inserts the most of them among his *Parasphalophora hermaphrodite*, Fam. *Calyptreæ*, but they seem to me to be all dioecious. † It is necessary to arrange with them the *Lottia* of Gray, which has a shell almost identical with that of *Patella*, but the animal is pectinibranchous. We have at least one native species, (*Pat. Clelandi*.)

† [Mr. Broderip has described many species in the 1st vol. of the *Trans. of the Zool. Society*, accompanied with beautiful figures; and Mr. Owen has given an excellent anatomy of the genus in the same work.]

‡ Apparently the same as the *Gedina* of Gray.—*Phil. Mag.* April, 1834.



duce the water to the branchial cavity placed upon the back, and closed in every other place. The respiratory organ consists in a few small leaflets, attached in a transverse line to the bottom of that cavity. The animal appears to have no tentacula, but only a narrow veil upon the head. There are